A COMPUTER MEDIATED LEARNING ENVIRONMENT FOR A JOINT AND EXPEDITIONARY MINDSET

Gary E. Riccio
Michael P. Lerario
The Wexford Group International

Robert P. Semmens
Imprimis, Inc.

Frederick J. Diedrich & Yale Marc
Aptima, Inc.

Gareth Digby
Augustine Consulting Inc.

August 2010

**United States Army Research Institute
for the Behavioral and Social Sciences**

REPORT DOCUMENTATION PAGE

1. REPORT DATE (dd-mm-yy) August 2010	2. REPORT TYPE Final	3. DATES COVERED (from. . . to) 14 May 2007 – 13 Nov 2009	
4. TITLE AND SUBTITLE A Computer Mediated Learning Environment for a Joint and Expeditionary Mindset		5a. CONTRACT OR GRANT NUMBER W91WAW 07 C 0030	
		5b. PROGRAM ELEMENT NUMBER A792	
6. AUTHOR(S) Gary E. Riccio[1] & Michael P. Lerario[2] (The Wexford Group International), Robert P. Semmens (IMPRIMIS, Inc.), Frederick J. Diedrich & Yale Marc (Aptima, Inc.) and Gareth Digby (Augustine Consulting, Inc.)		5c. PROJECT NUMBER 633007	
		5d. TASK NUMBER	
		5e. WORK UNIT NUMBER 360	

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
The Wexford Group International[1]   IMPRIMIS, Inc.   Aptima, Inc.
12 Massasoit Way   1150 Academy Park Loop, Ste 136   12 Gill St.,
Mattapoisett, MA 0273   Colorado Springs, CO 80910   Ste 1400
                                                                                                     Woburn, MA
                                                                                                      01801
 	
The Wexford Group International[2]   Augustine Consulting, Inc.
520 Southwest Broad Street   409 Washington Street, Ste 200
Southern Pines, NC 28387   Monterey, CA 93940
		8. PERFORMING ORGANIZATION REPORT NUMBER	

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U. S. Army Research Institute for the Behavioral & Social Sciences ATTN: DAPE-ARI-IJ 2511 Jefferson Davis Highway Arlington, VA 22202-3926		10. MONITOR ACRONYM ARI	
		11. MONITOR REPORT NUMBER Contractor Report 2010-02	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			
13. SUPPLEMENTARY NOTES Contracting Officer's Representative : Dr. Jennifer S. Tucker This contractor report was prepared as required by AR 70-31, under the terms of Department of Army Contract Number W91WAW07 C 0030/ The Wexford Group International.			

14. ABSTRACT *(Maximum 200 words)*:

The objective of the research was to develop a computer-mediated training environment to prepare ground component forces with the necessary cognitive skills for the emerging challenges of a Joint and expeditionary force. A key element of such a mindset is to be comfortable and proficient in interacting with people from different specialties for the purpose of collaborative problem solving at the boundaries between the known and the knowable. The product of this effort, Socrates Window, provides an open-source web-based solution that has the potential to facilitate interactions between students, instructors, and outside experts that blends classroom-based learning with distance learning. Evidence from stakeholders and end users, such as small group instructors in Army training and education, indicates that Socrates Window has both value and utility. It is not usable, however, in programs of instruction for which information technology and security constraints de-motivate use of social networking tools.

15. SUBJECT TERMS

Training   distance learning   Blended Learning   Collaborative Learning   Joint and Expeditionary Mindset   Social Networking   Joint Interagency Intergovernmental Multinational   Common Scenario   Mentoring   Web 2.0   Full Spectrum Operations   Counterinsurgency   Usability engineering   Captains Career Course

SECURITY CLASSIFICATION OF			19. LIMITATION OF	20. NUMBER	21. RESPONSIBLE PERSON
16. REPORT Unclassified	17. ABSTRACT Unclassified	18. THIS PAGE Unclassified	ABSTRACT Unlimited	OF PAGES	Ellen Kinzer Technical Publications Specialist 703-602-8049

i

Contractor Report 2010-02

A COMPUTER MEDIATED LEARNING ENVIRONMENT FOR A JOINT AND EXPEDITIONARY MINDSET

Gary E. Riccio
Michael P. Lerario
The Wexford Group International

Robert P. Semmens
Imprimis, Inc.

Frederick J. Diedrich & Yale Marc
Aptima, Inc.

Gareth Digby
Augustine Consulting Inc.

ARI – Fort Benning Research Unit
Scott E. Graham, Chief

U.S. Army Research Institute for the Behavioral and Social Sciences
2511 Jefferson Davis Highway, Arlington, Virginia 22202-3926

August 2010

Army Project Number
633007A792

Personnel Performance
and Training

ACKNOWLEDGMENT

Research Requirement:

The purpose of the research was to determine the components of the constructs associated with a Joint and Expeditionary Mindset, the fundamental attributes embodied therein, the operational capabilities to which it is relevant, and the environments suitable to enhance ground component Expeditionary Mindset and the associated Joint capabilities. The specific aim was to develop a computer-mediated training environment to prepare ground component forces with the necessary cognitive skills for the emerging challenges of a Joint and Expeditionary force.

Procedure:

A key aspect of our methodology was to assemble a group of technical, operational, and programmatic experts to examine assumptions, methodology, and conclusions in a collaborative working group over an extended period of time. Participants in the working group consisted of the investigators, including behavioral scientists and recently retired Army officers whose primary responsibility at the time of the investigation was identifying and promulgating lessons learned from Iraq and Afghanistan about asymmetrical warfare to active duty military units. The initial responsibility of the working group was to identify capabilities of high priority in Joint and expeditionary operations, priorities for which there is a convergence of evidence from different sources. The *Joint Capabilities Integration and Development System* (JCIDS) provided a structured methodology for identification of capability gaps and solutions. We utilized a general strategy typical of pre-systems acquisition to increase the likelihood that the innovation can be transferred to an environment of use within the Department of Defense (DoD).

We utilized a spiral development approach that has become predominant in software development. This reality demands persistent contact with end users and stakeholders to be able to trace the evolution implicit in the uses of a new product or service, to adapt what one comes to understand as the incidental features of a product, to come to a deeper understanding of the unique and essential attributes of the product, and to ensure that modifications and upgrades preserve the unique and essential attributes over the life cycle of the product. The development team maintained a habitual relationship with end users in the Maneuver Captains Career Course (MC3) over three years including changes in the chain of command and cadre.

We utilized multiple methodologies, including qualitative inquiry, because this is considered a best practice in usability engineering. Crystallization and constant comparison were the essential analytical tools. Crystallization involves finding fit and coherence in the evidence from users about the utility and value of an evolving design. It helps identify unintended consequences of design particular features, identify subtle functional interactions among features, and differentiate the essential from the incidental. Constant comparison involves crosschecking among the interpretations of different sources of evidence and vetting the interpretations with end users from whom design-relevant evidence was gathered. Consistent with best practices in usability engineering, we utilized a format for concisely capturing requirements implicit in the experience and opinions of end users and stakeholders. Value added by this practice is that it shows informants that their time was not wasted; it shows them that the

software developers were listening to what they had to say; and it reveals the potential impact of their time and their opinions in the requirements capture process.

The final stage of our usability engineering process was initiated once the design of Socrates Window was stabilized through formal systems engineering change control and configuration management. Two major groups of experts were utilized in usability trials with Socrates Window: (a) personnel from the Army Center for Enhanced Performance (ACEP) who had relatively little knowledge of Army operations, and (b) personnel associated with the Army Air Defense community who were knowledgeable about Army operations but from a different specialty relative to the MC3. The fundamental query of these outside experts was whether and to what extent Socrates Window provides outsiders with expeditious visibility into the MC3 sufficient to reveal their opportunities for influence on the MC3.

Findings:

Socrates Window provides an open-source web-based solution that has the potential to facilitate interactions between students, instructors, and outside experts that blends classroom-based learning with distance learning.

Evidence indicates general interest in the concept among stakeholders and end users such as Small Group Instructors (SGIs) in Army training and education. While the evidence indicates that Socrates Window has both value and utility, it is not currently usable in the MC3 environment primarily because of IT and security constraints that de-motivate use of social networking tools. Evidence from demonstrations and interactions with experts outside the MC3 indicated that value of the portal would be increased significantly by the addition of a portal view that guides collaborative work and further development of a common scenario, especially to the extent that the common scenario pushes subgroups of participants to and slightly beyond the limits of their experience.

Utilization and Dissemination of Findings:

Socrates Window will have value to instructors whose subject matter includes content and considerations that transcend the knowledge and experience of their specialty. To be useful within the Department of Defense, the innovation will have to be implemented by organizations that have responsibility for IT and security of web-based tools. This will be facilitated by the fact that Socrates Window will not be protected as intellectual property; it has been developed as an open-source solution. This open-source solution will be promulgated through publications that articulate its unique and essential attributes. More specifically, Socrates Window can be valuable in ongoing development of the common core and use of the common scenario across Captains Career Courses in the Army.

A COMPUTER MEDIATED LEARNING ENVIRONMENT FOR A JOINT AND
EXPEDITIONARY MINDSET

CONTENTS

CONTENTS (continued)

LIST OF FIGURES

CONTENTS (continued)

CONTENTS (continued)

A COMPUTER MEDIATED LEARNING ENVIRONMENT FOR A JOINT AND EXPEDITIONARY MINDSET

CONCEPT REFINEMENT

Needs Identification

Joint and Expeditionary Mindset (JEM)

When considering JEM, it is clear that the future force will not have the luxury to provide the Soldier with extensive training for particular regional assignments and cultures. Instead, Soldiers must be ready to be assigned anywhere in the world on relatively short notice. They must be prepared to adapt rapidly to situations in which factors of mission, enemy, terrain, troops, time, civilians (METT-TC) are unfamiliar or changing rapidly. They must learn to learn.

The reflections of LTG Petraeus on Iraq are instructive. They point to some of the issues and the level of analysis required in the development of training systems for cognitive skills needed in ill-defined cross-cultural situations (Petraeus, 2006):

- Understand local organizations and coordinate with specific individuals well enough to enable locals to take control of their own destiny.
- Make as many of the locals as possible feel that they have a stake in stability and reconstruction operations in which the U.S. military personnel are significantly involved.
- Understand the costs and benefits of every tactical decision in terms of its possible unintended consequences on the attitudes and actions of the local population.
- Develop networks for human intelligence at the level of neighborhoods because this is scale on which terrorists' tactics of intimidation and disruption are most effective.
- Anyone and everyone can become involved in civil affairs during stability and reconstruction operations irrespective of training in this area prior to deployment.
- Understand the interconnections among local institutions which provide the services on which a local population depends.
- Understand the values and associated cultural practices which give the local population its sense of identity and self worth.
- Understand the cultural ecology including political, economic, social, and physical conditions of people's daily lives.

LTG Petraeus emphasizes that one of the major obligations of Commanders to junior leaders is "to do everything possible to train them before deployment for the various situations they will face, particularly for the most challenging and ambiguous ones" (Petraeus, 2006, p. 7).

Such demands of the contemporary operating environment (COE) also have been noted recently by other military scholars who are mindful of lessons learned throughout the history of counterinsurgency (COIN; e.g., Kilcullen, 2006; Scales, 2006; Yates, 2006). The most important implications are to understand vulnerability of systems and infrastructure on which social stability depends. The other is the importance of human intelligence because it is both a robust

means for our adversaries to identify and exploit vulnerability and a means for U.S. forces to detect or defeat insurgents who employ idiosyncratic means of attack (Meigs, 2003).

As implied by the observations of Petraeus (2006), Kilcullen (2006, p. 1) aptly describes the most beneficial activities as those reminiscent of beat cop behaviors. He emphasizes that individuals should develop "a framework in which to fit every new piece of knowledge you acquire. Project handover notes from predecessors" (Kilcullen, 2006, p 2).

Military Training and Education

The objective of our ongoing research and development (R&D) reported here is to determine the constructs associated with JEM and to develop a computer-mediated *learning environment* to foster that mindset in ground combat personnel (Riccio, Lerario, Cornell d'Echert, Pound, Brunyé, & Diedrich, 2006).

We believe that a developmental perspective must be at the heart of any approach that purports to address or change mindset. From a developmental perspective, early to mid-career Army officers appear to be the students who would most benefit from an educational innovation directed at a JEM. More specifically, the Maneuver Captains Career Course (MC3) is an appropriate curriculum for JEM given that it focuses on Combined Arms Warfighting at the tactical level across the full spectrum of combat.

The MC3 divides the program of instruction into two phases: the Company Phase and the Brigade-Battalion Phase. We worked with the Company Phase in which all officers receive the same training on company-level full spectrum operations. There are several modules in the Company Phase, each approximately one week in duration. Our focus is on the module that addresses Stability Operations (SO).

The SO module expands the module previously entitled the Counterinsurgency (COIN) module, the end-states for which include: (a) quickly analyze, develop, and brief a tactically sound course of action; (b) understand the enemy (asymmetrical threat in a COIN environment); (c) understand where to defeat the enemy (terrain: urban environment); (d) understand how to defeat the enemy in the course of limited offensive operations; and (e) understand the capabilities of the assets in the Stryker Brigade Combat Teams (SBCT) Task Organization.

Pedagogical Approach

The MC3 program of instruction has been strongly influenced by guidance from the U.S. Army Training & Doctrine Command (TRADOC) and Combined Arms Center (CAC) to emphasize challenges of COIN in the COE, and to balance offensive, defensive, and stability operations. The classroom environment focuses on small groups of up to 16 Captains led by a Small Group Instructor (SGI). Each module generally utilizes (a) doctrinal lectures, (b) historical vignettes, (c) readings and videos, (d) tactical decision exercises (TDE) in which students participate, and (e) SGI-led discussions. SGI-led TDEs and discussions provide opportunities for collaborative learning. Instructors can provide opportunities for collaborative experiential learning by introducing new situations, rich in detail, to a class along with general principles and

methods for making meaning of the details. They can thus reveal to students the ways in which knowledge is situated. Understanding the influence of local or momentary ecology (e.g., physical and cultural surroundings) on an unfolding event helps students generalize from their own experiences and classroom experiences to new situations (Brown, Collins & Duguid, 1989; Gibson, 1991; Lave & Wenger, 1991).

The common details and scenarios of a classroom experience also foster collaborative learning among the students. One learner can make personal connections between sets of concrete details that initially may seem bewildering to others. In a collaborative environment, the idiosyncratic connections and meanings that individual students make of the classroom experiences provide opportunities for all students to be exposed to the perspectives of others (Bandura, 1997; Lewin, 1948). This provides each student with a foundation for comprehending and potentially for adopting multiple perspectives. Accordingly, ***a key objective of our R&D is to help achieve and implement a methodology that promotes experiential, participatory, and collaborative learning.***

The Army Guided Experiential Learning (GEL) model (e.g., Clark, 2004; Markley, 2007) holds the promise of meeting many educational needs. Nevertheless, it is prudent to consider a variety of alternative methods, including problem-based ones, which may be more effective for certain kinds of learning (e.g., see Bransford, Brown, & Cocking, 2000). Problem-based methods hold the promise of challenging trainees to think, and to discover what they know and need to know, thereby facilitating deeper understanding. As Bransford et al. (2000) note, the true challenge is to identify the right techniques and technologies required for learners to achieve the learning objective at hand. Whether inquiry-based, lecture-based, technology-enhanced, or skills-based, no one approach will be effective in all circumstances.

The argument for a multifaceted approach underscores the general need for a ***learning environment*** to be learner-centered, knowledge-centered, assessment-centered, and community-centered (cf., Bransford et al., 2000). To be learner-centered, a learning environment must address what learners bring to the table–what they know, what they don't know, what they need to learn, and what they are motivated to learn. To be knowledge-centered, effective learning environments must be rooted in well-structured bodies of knowledge that encourage deep understanding and reflection. They encourage sense-making rather than mere memorization. To be assessment-centered, learning environments must provide formative feedback and not only summative evaluation. To be community-centered, there should be exploration in an open environment that is relevant to, and reflects, the community in which it is embedded. Similarly, Wallace (2006) has argued that the Generative Force must be closely coupled to the Operational Force. The challenge is to use a variety of technologies and techniques that find the "sweet spot" at the intersection of these objectives (see also, Scales, 2006).

In the following sections, we describe methods and progress from our efforts to identify requirements for technological support and educational approaches to close the gap between the classroom and the operational environment.

Method

Qualitative Inquiry

A key aspect of our methodology was to assemble a group of technical, operational, and programmatic experts to examine assumptions, methodology, and conclusions in a collaborative working group over an extended period of time (Riccio et al., 2006; Riccio, Sullivan, Klein, Salter, & Kinnison, 2004). Participants in the working group consisted of the investigators, including behavioral scientists and four recently retired Army officers whose primary responsibility at the time of the investigation was identifying and promulgating lessons learned from Iraq and Afghanistan about asymmetrical warfare with active duty military units. The activities of the standing working group occurred over a six month period and included participant observation, interviews, document analysis, memo writing, constant comparison, cross checking, achieving a balance and tension of multiple perspectives, and development of grounded theory (see Camic et al., 2003; Denzin & Lincoln, 2003). The initial responsibility of the working group was to identify capabilities of high priority in Joint and expeditionary operations, priorities for which there is a convergence of evidence from different sources. The *Joint Capabilities Integration and Development System* (JCIDS) provided a structured methodology for identification of capability gaps and solutions (Chairman of the Joint Chiefs of Staff, 2004). Key elements of the JCIDS methodology include Functional Area Analysis (FAA), Functional Needs Analysis (FNA), Functional Solution Analysis (FSA), and Post Independent Analysis (PIA).

Three focus group events were conducted with the participants of our standing JCIDS-based working group. They occurred during the first two months of the project and were separated by at least two weeks. Each focus group event occurred over a two-day period. Sessions on consecutive days were between two and four hours in duration. The first focus group identified facets of the problem, participants, and stakeholders. The second focus group event addressed the FAA and FNA and the third addressed the FNA and the FSA. Considerations, recommendations, and opinions of the working group were documented in text and graphics. This helped to avoid a narrow focus from a dominant perspective. In the spirit of the PIA step in the JCIDS process, conclusions from the FNA and FSA were vetted through frequent coordination with potential users and stakeholders. The intent was to facilitate development of capabilities that can be transitioned almost immediately. The primary source of stakeholders and users was the MC3.

After the FSA, work was initiated on a prototype web-based tool that can be used in environments such as the MC3 to help SGIs prepare ground component forces with the necessary cognitive skills for the emerging challenges of a Joint and Expeditionary force. Development of the tool generated additional, more refined, questions that required a second round of collaborative inquiry with subject matter experts (SMEs). This iterative cross-fertilization between software development and interactions with users about the resulting capabilities ("spiral development") continued throughout the project.

Surveys and Associated Interviews

Following the initial qualitative inquiry, a two-page survey was distributed to 52 current and retired Army personnel representing a variety of ranks (COL to 2LT) and years of military service (1 to 31 years, M=10 years) to reveal additional facets of the problem that had not been addressed in the FAA, FNA, and FSA. More specifically, the survey was divided into two categories of questions. The first set of questions addressed COE knowledge such as how important information about the COE is to a Soldier's survivability, how long does it take to gather information, and what are the key sources of information gathered. The second set of questions addressed electronic collaborative tools such as whether such tools can be an effective way to share COE information, whether people are willing to use them, whether people are able to use them.

There were two types of survey responses. First, a 5-point Likert-type scale was used to assess participants' level of agreement with certain statements, such as "Information about the COE is important to a Soldier's survivability." Second, participants could rank a given list of items, such as ranking sources of COE information.

Broader Interviews

To facilitate analysis, follow-up interviews with two military education experts were then conducted to help interpret the survey results and to stimulate broader discussion with the two experts (Tashakkori & Teddlie, 1998). In the second part of each interview, the two experts were asked for their opinions on issues related to learner-centered, knowledge-centered, assessment-centered, and community-centered aspects of military training and education that were most important in the context of the findings from the FAA, FNA, and FSA.

Results and Discussion

Functional Area Analysis

In the JCIDS-based FAA, the working group identified the implications of Joint Operations Concepts (JOpsC), Joint Operating Concepts (JOC), and Joint Functional Concepts (JFC) for training JEM. The relevant JOpsC are *fully integrated, expeditionary, networked, decentralized, adaptable, and decision superior* (DoD, 2003). An important implication of these attributes is that individuals and units must be rapidly deployable, employable and sustainable in areas of operation that may have a minimum of existing infrastructure.

The JOpsC are fostered by timely and accurate communication about relevant situations and lessons learned. Relevance, timeliness, and accuracy are fostered by two-way communication that helps individuals understand the contexts within which information is presented and received, elaborate on actual or potential misunderstandings, and establish the credibility of the source. There is rapid growth in capabilities that help link individuals who have a need to know with appropriate experts.

The JOC span Full Spectrum Operations (DoD, 2004b). The biggest challenges for Joint and expeditionary operations are *rapid transitions between offensive, defensive, and stability operations*. There are profound issues in these transitions for individuals and for units over short and long time scales. Rapid transitions that are especially difficult involve in-stride changes between lethal and nonlethal actions. With respect to longer-term issues, the working group identified the following question as a powerful guideline for training: "What would Soldiers do differently if they knew they had to stay and fight for the duration of the operation?" This mindset helps a Soldier take ownership of the job of the person to be replaced rather than merely taking the place of that person.

In the context of the JOpsC attribute of decentralized, and especially in the context of the stability operations, the Joint Functional Concept (JFC) of *Joint Command & Control emphasizes the importance of a subordinate leader's ability to act on the basis of broad statements of commander's intent* (DoD, 2004a). Similarly, it is important for commanders to be able to provide subordinates with clear direction without presumptive detail about implementation. In essence, commanders and subordinates must learn to strike a balance in the natural tension between command and control.

Functional Needs Analysis

In the JCIDS-based FNA, the working group focused on two major components of expeditionary mindset: Getting there and being there. "Getting there" skills and issues include: (a) no-notice or short-notice deployment sequence; (b) area studies to gain general knowledge of potential threats and environments; and (c) basic Soldier skills such as move, shoot, communicate, and first aid. "Being there" skills and issues include (a) coordination and interaction with other government agencies (OGA) and non-government organizations (NGO); (b) population engagement, both the leadership and masses; (c) offensive action to destroy insurgent elements; and (d) intelligence collection and analysis. No matter where "there" is, the problem sets and resources will be similar: tribal and political, OGA and NGO interaction, offensive and defensive operations.

The intent of the working group was to identify urgent needs related to JEM in current operating environments. Given this, and in retrospect, it is not surprising that we identified some nascent solutions in the activities of networked, decentralized, and adaptable forces (both the Generative and Operation Force). Two kinds of emerging solutions are represented by the Battle Command Knowledge System (BCKS) and CAVNET. The CAC BCKS is an online knowledge management system for the generation, storage and rapid retrieval of information (Kerr, 2006). BCKS includes a forum for interaction between individuals as well as a database of documents (Warrior Knowledge Base). The database includes many thousands of knowledge objects. There are capability gaps in BCKS, however, that derive from the quantity of relevant material and number of individuals to which it provides access.

One capability gap is the difficulty in *finding the right information in the right amount and in the time the user has available.* This is a common problem with knowledge databases that provide a plethora of information that is apparently or actually relevant to a user's needs. To address this gap, methods of training are being considered which could help achieve a virtual

"right seat ride" for novice users (Kerr, 2006). We believe that this is the most promising approach to making a database both usable and useful.

Another capability gap is in measures of effectiveness (MOE). The common approach to MOEs in a knowledge database or other web-based capabilities is to count number of objects on the site or how many times the site is accessed ("hits"). This is very limiting, and it sheds little or no light on the value of a web site to users. MOE are needed which provide insight into the nature and extent of the impact of a web site on users, whether any learning has taken place, or whether the meaning or use made of the information is valid. *The expert guidance implied by the virtual right seat ride could provide a path to more meaningful MOE*. In principle, experts could provide subjective assessments of individuals they are guiding.

CAVNET is a method of sharing information, peer to peer, which conceptually builds on predecessors such as Platoonleader.com and Companycommander.com. CAVNET has demonstrated the concept for providing peer-to-peer information sharing on a secure network in theater. It was first established for the 1st Cavalry Division in Iraq in April 2004 (PBS Frontline, 2005). Since then, 3rd Infantry Division ("Marnenet") and the 4th Infantry Division ("Ironhorsenet") have, in turn, adopted the system and are using it in Iraq. The Internet allows many people to communicate instantly about topics of mutual interest. There is demand for any such resource because of the need to share the emerging enemy and friendly tactics, techniques and procedures. There is a need to achieve competitive advantage against a networked, adaptable, and cellular enemy force. In essence, CAVNET demonstrates one method to provide a *trusted source of knowledge for junior leaders on a time scale that allows these users to establish credibility, validity, and relevance of the information and to act on it*, that is, to expedite the sharing of actionable intelligence.

The next logical step is to utilize such a capability in closing the gap between the institutional Army and the operational Army—to reduce the "…lag between what is being taught in the classrooms and evaluated at the training centers and what is being executed on the ground in combat" (PBS Frontline, 2005). Like BCKS, however, the success of CAVNET brings capability gaps that derive from potential access to vast amounts of information and large numbers of individuals.

Functional Solution Analysis

The key finding from our JCIDS-based working group was that there is a need for a tighter coupling between educational institutions and the current operations in theater. Given that the MC3 arguably is on the cutting edge in closing this gap, the question becomes how best to establish even closer integration of the educational and operational environments. The JCIDS-based FSA converged on *computer-based tools that allow experts in the COE (ECOE) to communicate directly with students and become a resource to SGIs* in the MC3. The toolset will allow SGIs, students, and ECOEs to interact online regarding key issues, topics, or documents of interest (Figure 1).
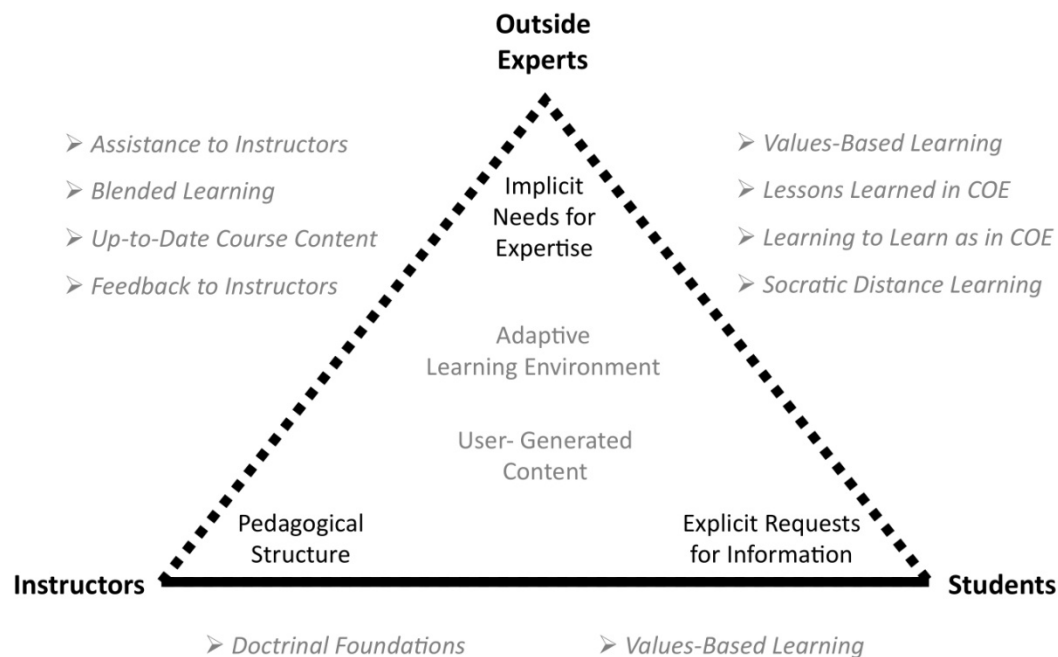
Figure 1. Opportunities for COE experts to assist SGIs in closing the gap between classroom and COE.

By enabling such interaction, students can explore how concepts learned in the classroom relate to current issues. They can actively pull relevant information from experts in theater or who are otherwise closer to the roles in which students will find themselves after deployment. The key insight is that a dialogue must develop that allows exploration through questions and answers in which the student can be guided to make non-trivial links between doctrine, classroom exercises, and current practice. The notion is that, by guiding student dialogue with ECOEs, instructors can facilitate early rudimentary "Right Seat Rides" that begin familiarization and make abstract lessons more concrete and actionable. *The outcome should be Soldiers who have learned to learn, and who are ready to learn once deployed into a changing or ill-defined situation.*

Post Independent Analysis

The primary thrust of work is not the software tool to support dialog – indeed, simple functions like chat and virtual whiteboards already exist. *Our focus is in how to structure such an environment to achieve a significant improvement in learning*, and in particular, its ultimate impact on cognition and action in the COE. Our interactions with users and stakeholders were critical in the development and integration of the materiel and nonmaterial components of the capability. Concepts about the software tool, the needs for it, and the use of it were examined collaboratively as the concepts developed and as they were instantiated in initial builds. Interactions with users and stakeholders utilized a multifaceted methodology including interviews, document analysis, and naturalistic observations (Camic et al., 2003; Denzin & Lincoln, 2003; Tashakkori & Teddlie, 1998). The concurrent development of a grounded theory

builds on the framework of Bransford, et al. (2000). The reciprocal influence among these concurrent activities instantiated a spiral development approach consistent with an evolutionary acquisition strategy (Defense Acquisitions University [DAU], 2003). Our assumption is that this framework for our R&D would facilitate transition of our innovation (see section on "Critical Considerations for Transition").

Survey and Associated Interview Results

COE Knowledge. Respondents believed that information about the COE is very important (M = 4.65/5, SD = 0.59) to a Soldier's survivability. When asked to estimate how long it takes a Soldier to acquire critical information about the COE, 50% of participants responded 1-2 months, while another 20% indicated 2-4 months. Surprisingly, approximately 20% indicated that it takes only 1-2 weeks to acquire information on the COE. Results from follow-up interviews revealed that these respondents may fall into two very different categories: members of rapid deployment teams and novices. The former are trained to gather and share information on the COE in a rapid manner, while the latter may simply be unaware of all the information they need to know. The remaining 10% of the participants chose either 1-2 days or 4-6 months.

Soldiers indicated that they most commonly use first hand experience and right seat rides (RSRs) as sources of critical information about the COE, followed in decreasing order by verbal word-of-mouth (from lateral ranks), verbal word-of-mouth (from superiors), verbal word-of-mouth (from subordinates), unofficial written or electronic documents, and official written or electronic documents. RSRs can be particularly valuable in learning the geography of the COE. However, several respondents noted that the quality of RSRs can vary drastically. Interviewees indicated that the attitude of the incoming or outgoing units can greatly impact the quality of a RSR. For example, if the outgoing unit is focused on going home after a lengthy deployment, then they may not be motivated to conduct a thorough RSR. Similarly, if the incoming unit believes that it knows everything about the COE already, they may not attend to the information in the RSR as closely as perhaps they should.

Soldiers ranked both official and unofficial written or electronic documents as being the two least commonly used sources of COE information. Interviewees indicated a variety of reasons why these potentially valuable sources of information are not commonly used. For instance, Soldiers may be required to read through often voluminous amounts of data. While units often do make storyboards, briefings, and other materials available to other units, it would be time consuming to review it all. Furthermore, Soldiers may be unable to review such materials because of limited SIPRNET access.

Not surprisingly, the majority of respondents (55%) stated that some COE information sources are underutilized. However, 45% of respondents believed that there are no underutilized sources. Interviewees were surprised by the number of respondents who answered this way. They suggested that less experienced Soldiers might not be aware of what other types of information could help them to learn about the COE. Indeed, 'yes' responses were positively associated with years of military service.

Electronic Collaborative Tools. Respondents believed that electronic collaborative tools are useful for sharing COE-relevant information (M = 4.11/5, SD = 0.81) and that they would be likely to use tools for distance learning (M = 3.98/5, SD = 0.77). They ranked the following communication modalities according to their likelihood of use in decreasing order: Asynchronous one-to-one communications (such as an electronic mail service)*;* Synchronous one-to-one communications (such as a text-based real-time messaging service between two individuals)*;* Asynchronous one-to-many communications (such as posting on an electronic bulletin board)*;* Synchronous one-to-many communications (such as a text-based real-time messaging service between multiple individuals).

Respondents also indicated they would be both willing and able (M = 3.86/5, SD = 0.89) to participate in teaching about the COE using electronic collaborative tools. Furthermore, Soldiers believed that electronic collaborative tools for distance or local learning can contribute to Soldier survivability by bridging the gap between a learning environment and the COE (M = 4.06/5, SD = 0.75).

Interviewees were somewhat skeptical of the respondents' actual ability to participate in teaching. Once deployed, Soldiers have many demands of their time. Even the most well-intentioned Soldiers may find that they either do not have the time to teach or that they have unreliable computer access. However, *the key to promoting usage among deployed Soldiers is to make it as easy as possible for them to use the tool*. Interviewees recommended strategies such as having the tool be compatible with Microsoft Outlook so that scheduled sessions would be imported into Outlook. Additionally, interviewees recommended including an email functionality through which users can send links to other users. That way Soldiers would not be required to log in to the tool every day to search for relevant information but rather the information would be pushed to them.

Broader Interview Results

Community-centered learning environment. Bransford et al. (2000) note that community-centered learning environments focus on two key elements: (a) an environment in the classroom that encourages open discussion, including discussion of misconceptions, in a non-judgmental manner; and (b) creating an environment that is tied in tangible ways to the community it serves such that the learning is seen as relevant. From this perspective, the following key insights emerged from working group discussions, surveys, interviews, and associated document reviews.

The first key element of community-centered learning environments is consistent with the Army's approach to After-Action Reviews (AAR) and belief about their general importance. AAR-style interactions are common in the MC3 and in other venues of Army training and education, and are typically conducted in an open and non-judgmental manner. A computer-based tool for instructional dialog can facilitate AARs by reminding participants to conduct them in a nontrivial, open fashion.

The second key element of community centered learning is actually the central focus of the current work—helping to close the gap between the classroom and the COE. *Our vision is for*

students and SGIs to have the capability for web-based interaction with individual ECOEs almost anywhere at anytime. Any progress toward achieving this vision would be welcome at the MC3 and presumably many other sites of military training and education.

Bransford et al. (2000) describe community-centered learning as the proper backdrop for learner-centered, knowledge-centered, and assessment-centered aspects of effective educational environment. Accordingly, additional issues deriving from a community-centered approach are described below in the context of the implications for learner-centered, knowledge-centered, and assessment-centered environments.

Learner-centered learning environment. Following Bransford et al. (2000), we assume that the key element of being learner-centered is to ensure that the learning environment adequately addresses what students know, do not know, and how they are motivated to learn. Learners start at different places, with different strengths and weaknesses, and different gaps in their understanding. From this perspective, the following key points emerged during our investigation.

Dialog has the potential to help reveal what students know, don't know, and how they come to know. The small group environment of the MC3 provides opportunities for instructors to dialog with students and for students to dialog with each other. It would be beneficial to increase opportunities such as these and to make them more effective. Two ways to increase effectiveness are (a) to make opportunities for dialog available when students are most highly motivated to receive and pull information from others, and (b) to identify and promulgate lessons learned about practices in instructional dialog that students and instructors find to be useful.

Computer-mediated methods of dialog, in principle, can *facilitate the capture and archiving of best practices as well as collaborative insights that emerge in dialog between novices and experts*. In the application at hand, we assume that best practices will have the characteristics of Socratic dialog. Instructors or other experts should lead students to discover connections or implications for themselves rather than simply telling them "the answer." That is, students should be guided in how to think, not told what to think.

Computer-mediated activities also allow for personal structuring of information that emerges in the activities. This presents tradeoffs for design and use of the tool, however, because student-driven structure can undermine pedagogically-driven structure for course materials and methodology. Nevertheless, a capability for student-driven structure should be explored given the motivational value and carry-over effects of anything that promotes active learning.

Web-based dialog, in principle, increases access to a wide variety of experts. In the present application, the most valuable experts are active duty personnel in theater or who are otherwise close to the roles in which students will find themselves after deployment. The role of such ECOEs in web-based dialog is important to the extent that students will be more likely to be influenced by the behavior of others if it results in outcomes they value, if the other person is similar to the student and has admired status, and if the behavior has functional value (Bandura, 1997).

Knowledge-centered learning environments. To be knowledge-centered, a learning environment must go beyond simple memorization of facts and disconnected elements. Rather, learning environments should foster sense-making–deep understanding involving rich, deep causal connections (Bransford et al., 2000). While this may seem obvious, even the best curricula can benefit from continual vigilance about the coherence and relevance of the big picture. The world changes, thus the key integrating themes for a curriculum may need to be updated from time to time. From this perspective, the following key insights emerged from our investigation.

Socratic dialog with ECOEs can reveal to students the ways in which knowledge about the operational environment is situated in contemporary nuances of political, military, economic, and social factors as well as infrastructure, information, physical environment and time. Understanding the influence of local or momentary ecology on an unfolding event helps students generalize from their own experiences and "classroom" experiences to new situations (Gibson, 1991; Gibson, 1977; Lave & Wenger, 1991).

While dialog with ECOEs can help to develop integrated sense-making—in light of connections to real problems in the COE—facts and issues may still be somewhat difficult to comprehend in absence of direct experience with the particular roles (e.g., of Company Commanders) in the COE. Stories by ECOEs and instructors can help provide ways to integrate knowledge into meaningful wholes. *Dialog and sharing of stories, however, must be grounded in curriculum objectives and associated course materials*.

One important element of curriculum, as a whole, is the developmental perspective. Students must be prepared for learning at the level required in any particular course. Course content and methodology takes into account such prerequisites. This is difficult to ensure in a rapidly changing curriculum. Such situations demand extra vigilance by instructors in attending to the meaning that students make or are able to make of course material and experiences in the learning environment. In this respect, web-based dialog with ECOEs is not likely to be pedagogically effective unless ECOEs can be resources that can be harnessed by the SGIs.

An enabling objective of our approach is to combine the best of knowledge databases with the best of on-line help from an expert by providing a way in which each can leverage the strengths of the other. An expert can help a novice navigate quickly and efficiently through an otherwise potentially overwhelming amount of information (e.g., course materials). At the same time, the need to know about something specific, something which is potentially available in a database, grounds and contains a dialog which otherwise could become tangential, divergent, or inefficient.

Guidance through an overwhelming and unfamiliar body of information is no different from what a skilled teacher or mentor does in introductory phases of any curriculum. Similar benefits can accrue from a capability that would enable experts to guide novices "on line" as a mechanism of distance learning. Grounding dialog between a student and an instructor in specific learning objectives is no different from what occurs in any educational situation. The implication in the present case is to provide a capability for on-line dialog between a third-party expert and a student to be harnessed by learning objectives of the instructor. In essence, the

strategy is to blend classroom education with distance learning in a way that each facilitates and gives meaning to the other.

Assessment-centered learning environment. Following Bransford et al. (2000), learning environments should be go beyond summative assessments; that is, identifying what students can produce on a test or a paper at the end of the course. While meeting standards is critical, Bransford argues that assessment-centered environments must focus on formative assessment; that is, uncovering misconceptions and providing feedback in an open atmosphere. From this perspective, the following points emerged from working group discussions, surveys, interviews, and associated document reviews.

Many current methods of assessment are not sufficient in that they do not peel back the layers of the learning process. In this sense, it is critical to *develop and utilize measures of process (MOP) as well as outcomes or measures of effects (MOE).* Computer-mediated activities can provide a window into the thinking of the student. In principle, one can trace the dialog that leads to an insight or to a dead end. The selection, use and storage of information can be traced. Such sources of potential MOPs should be explored in the development of the tool.

MOPs will be valuable for continual improvement of the utilization of ECOEs as well as in the improvement of learning by students. The contributions of ECOEs can be assessed with respect to the ideals of Socratic dialog. SGIs can provide such feedback to ECOEs to make them more useful resources to the SGI. Over time, lessons learned and best practices can be captured in "train the trainer" packages for ECOEs and SGIs.

MOEs typically are difficult to obtain if the intent is to identify the impact of training or education on subsequent behavior or performance (e.g., in a job, assignment or duty position). There are two ways that web-based utilization of ECOEs could help identify the efficacy or utility of learning. First, ECOEs are more likely to be able to appreciate the implications of a student's knowledge or thinking for performance in theater, that is, to assess the potential impact of learning. Second, former students who have experienced the web-based dialog with ECOEs in a blended learning environment may, themselves, become ECOEs. This would provide valuable direct feedback on the actual impact of learning.

In summary, our work to date on tools and methods to close the gap between the classroom and the operational environment appear to provide promising opportunities to address learner-centered, knowledge-centered, and assessment-centered needs of an effective learning environment. These preliminary conclusions are supported by generally enthusiastic responses of users and stakeholders in both the Generative and Operational Force.

FORMAL DEVELOPMENT OF A NEW CAPABILITY

Critical Considerations for Transition

Transition of an idea or innovation to an environment of use in the DoD depends critically on systematic development of requirements that are relevant, effective, and reasonable with respect to an anticipated environment of use (Chairman of the Joint Chiefs of Staff, 2004; DAU, 2003). The DoD acquisition community depends on the DoD user community for the development of such rational and useful requirements. The DoD science and technology (S&T) community can play a critical role in helping develop requirements that bridge the gap between user's statements of need, their expectations about solutions, and specifications with which capability developers and providers can work. The S&T community also can play a valuable role by ensuring that requirements are traceable back through the process by which they were developed. This is critically important to developers and providers who may have to re-examine assumptions as the application environment changes over the life cycle of a capability. Toward that end, we conceptualized and approached our R&D in terms of a framework that is familiar to the DoD acquisitions community.

Programmatic risk reduction is an important objective of our pre-systems acquisition strategy for developing a computer-mediated learning environment to foster JEM. Systematic development of traceable requirements is one aspect of this strategy. Another aspect is involvement of potential users and stakeholders throughout the period of performance for the R&D—to develop a habitual relationship with individuals in a plausible environment of use. A third aspect is to leverage existing capabilities and lessons learned, most notably in the commercial sector. This is an established practice in rapid acquisitions with which several members of our team have considerable experience.

Best Practices in Usability Engineering

The software market is increasingly a dynamic and unpredictable environment. So-called "Web 2.0" products typically morph into applications and patterns of use that are not entirely anticipated and in some cases quite surprising. "Continuous Beta" (spiral development) has become the mantra of software development. This reality demands persistent contact with end users and stakeholders to be able to trace the evolution implicit in the uses of a new product or service, to adapt what one comes to understand are the incidental features of a product, to come to a deeper understanding of the unique and essential attributes of the product, and to ensure that modifications and upgrades preserve the unique and essential attributes over the life cycle of the product. Usability engineering has been rapidly co-evolving with the climate of spiral development as lessons are being learned about how to trace and guide the evolution of a software product. A key consideration is how to maintain constant stakeholder involvement without being intrusive, to achieve evidence-based design that captures the breadth of experience with the product, and that enables rigorous tracking of lessons learned and associated design modifications based on such information about use (Beale, Courage, Hammontree, et al., 2008; Carrol & Rosson, 2007; Friedman, Kahn, & Borning, 2009; Kantner, Sova, & Anschuetz, 2005; Reddish, 2007).

Use of multiple methodologies including qualitative inquiry, as in our work, is considered a best practice in usability engineering. Crystallization and constant comparison are the essential analytical tools. Crystallization involves finding fit and coherence in the evidence from users about the utility and value of an evolving design. It helps identify unintended consequences of design particular features, identify subtle functional interactions among features, and differentiate the essential from the incidental. Constant comparison involves crosschecking among the interpretations of different sources of evidence and, most notably in our work, vetting the interpretations with end users from whom design-relevant evidence was gathered. This holistic process enables one to find value in small amounts of evidence that often are the only kinds of evidence that can be gathered in usability engineering. The whole is greater than the sum of the parts. Consistent with best practices in usability engineering, we utilized a format for concisely capturing requirements implicit in the experience and opinions of end users and stakeholders. In particular, a "quad chart" was developed after each significant interaction with such informants (see e.g., Figure 2). The quad charts subsequently were shared with the informants to check accuracy and priority of the interpretations and actionable recommendations. Value added by this practice is that it shows informants that their time was not wasted; it shows them that the software developers were listening to what they had to say; and it reveals the potential impact of their time and their opinions in the requirements capture process.

SOCRATES' WINDOW

BRINGING THE COE INTO THE CLASSROOM

Meetings at MC3 Week of 27 Nov 2006

Personnel with whom we interacted

➢ Director of CATD
➢ SGI (observed class)
➢ SGI (observed class)
➢ SGI (Team Chief)
➢ SGI (Module Director)

Key points from MC3 personnel

➢ COIN module will be expanded
➢ SGI rotations at CTCs every 90 days
➢ Feedback from Commanders through Quality Assurance Office
➢ MC3 interaction with personnel in Theater can be a win-win situation
➢ Important for students to understand repercussions of command decisions
➢ COIN environment more relevant than COIN operations at tactical level
➢ Continuity across rotations (RIP-TOA) is a major factor for effectiveness—Unity of Effort

Key points from our observations

➢ Experts in the COE (ECOE) can fit into small group teaching methods in MC3
➢ Interplay between general principles and specific details is critical
➢ ECOE can help students avoid assumptions about "school solutions"
➢ General principles help connect COIN module with other modules in MC3

Next steps

➢ Explore opportunities to blend distance learning with learning in MC3
➢ Vet ideas with SGIs about how they can control ECOE as a resource
➢ Sit in on expanded COIN module in March 2007
➢ Review coordination between Fort Benning and Fort Knox
➢ Facilitate meeting between CATD (MCCC) and AWG

2

15

SOCRATES' WINDOW

BRINGING THE COE INTO THE CLASSROOM

Interview with Chief of Tactics 11 November 2009

Key points about Chief of Tactics
- Served as Chief of Tactics, CATD JUN 07-JUN 09
- Supervised SGIs for the MCCC
- Responsible for the MCCC Program of Instruction (POI)

Key points from Chief of Tactics
- Assumptions:
  - MCCC's primary purpose is to train Company Commanders for the BCTs
  - Second purpose is to train Operations (AS3) Officers for Battalions and BCTs
  - MCCC needs to help Captains learn how to do in-depth analysis, not just the quick FRAGO
- Nature of protracted warfare requires Army leadership to stop "micro-management" of Companies and Platoons
- Incorporation of a "Total Government Approach" is needed
  - Allow military to focus on Security Operations
  - SW helps train the Inter-Agency as well as Military
- TDEs are essential to learning, especially remediation
  - Real world examples are available and powerful
  - Ambiguity, no one right answer makes best TDE

Key points from our observations
- Outside Experts key to the development of analytical skills outside of basic Infantry skills
- For immediate impact, it is not enough to train Captains in JEM; Senior Leadership must be "on board"
- SW can facilitate development across Joint, Inter-Service, Inter-Agency, Multinational (JIIM) Operations and Environments
- Stories (TDEs) build on what you know; help to identify what you don't know
  - Open-ended stories; many possible decisions and outcomes

Next steps
- Show the "two-way" value of SW to train the Experts as much as the Students
- Develop Stories (TDEs) the facilitate development among all parts of a JIIM operation or environment
- Goldwater-Nichols Act needed for the Inter-Agency

The Wexford Group International - Proprietary Information   3

Figure 2. Two of the quad charts generated over the three-year period of habitual interactions with end users and stakeholders.

16

SYSTEM DEVELOPMENT

Operational Architecture

The most fundamental insight about the operational architecture (Figure 3), in the context of patentability, is that the unique and essential attributes of Socrates Window provide outside experts with *sufficient visibility* into the course to enable *opportunities for influence* in the context of mentorship (i.e., one who deeply knows a learner and is committed to development of the learner).
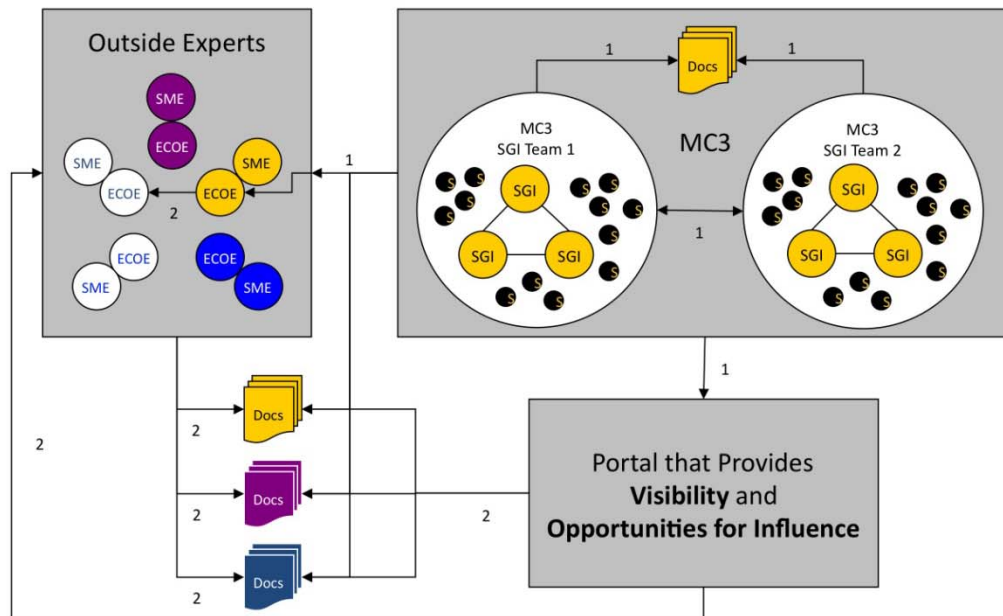
Figure 3. Operational architecture for the Socrates Window.

Capabilities Integration

Users will use what they can use, especially what is at hand, and will not let product manufacturers or purveyors dictate to them how and when they should do something. Users cobble together an off-the-shelf bundle. Tracking this doesn't require formal system-of-systems integration but it reveals the potential *family-of-systems integration* that can be done on the fly by end users (Figure 4). This fact of use should be considered explicitly in the requirements elicitation process with stakeholders and end users.

The viability and value of the core concept has not changed over the course of the project. Due diligence on the rapidly evolving capabilities of Web 2.0 continue to show that the operational architecture for Socrates Window addresses a *gap in current web-based learning and knowledge sharing*.

Figure 4. Highly stylized depiction of the bundling of an array of different products by end users based on convenience, personal preferences, or organizational demands.

Spiral Development

The development team maintained a habitual relationship with end users over three years including two changes in command as well as changes in the SGI cadre. We developed a process by which we could (a) maintain this relationship, (b) frequently elicit feedback, and (c) could be responsive without being intrusive to the SGI cadre or their chain of command. The considerations that drove the development of this process include:

- Establish rapport and trust with a group of end users to get visibility into their operating environment and to have opportunities for influence on it.
- Visibility and opportunities for influence enable the identification of implicit needs as well as explicit requests for new capabilities.
- Provide liaison between development team and end users to minimize demands on end users and to maximize impact of interactions with end users.
- Employ systems engineering process including key personnel on development team to maintain focus and adaptability as understanding of needs evolve.
- Employ collaborative decision-making by user liaison, programmers, project management, and quality assurance to maximize value for end user.
- Two levels of quality assurance increase the likelihood that interactions with end users are positive and successful.
- Site visits are necessary but not the only way to maintain connections between development team and operating environment of end user.

The process is depicted in Figure 5. An important element of this process is a tiered organization of the development team that insulates end users and stakeholders from unnecessary detail, jargon, and esoteric concepts of the development process yet keeps scientists and engineers grounded in the evolving needs (and the evolving understanding of needs) of end users and stakeholders.
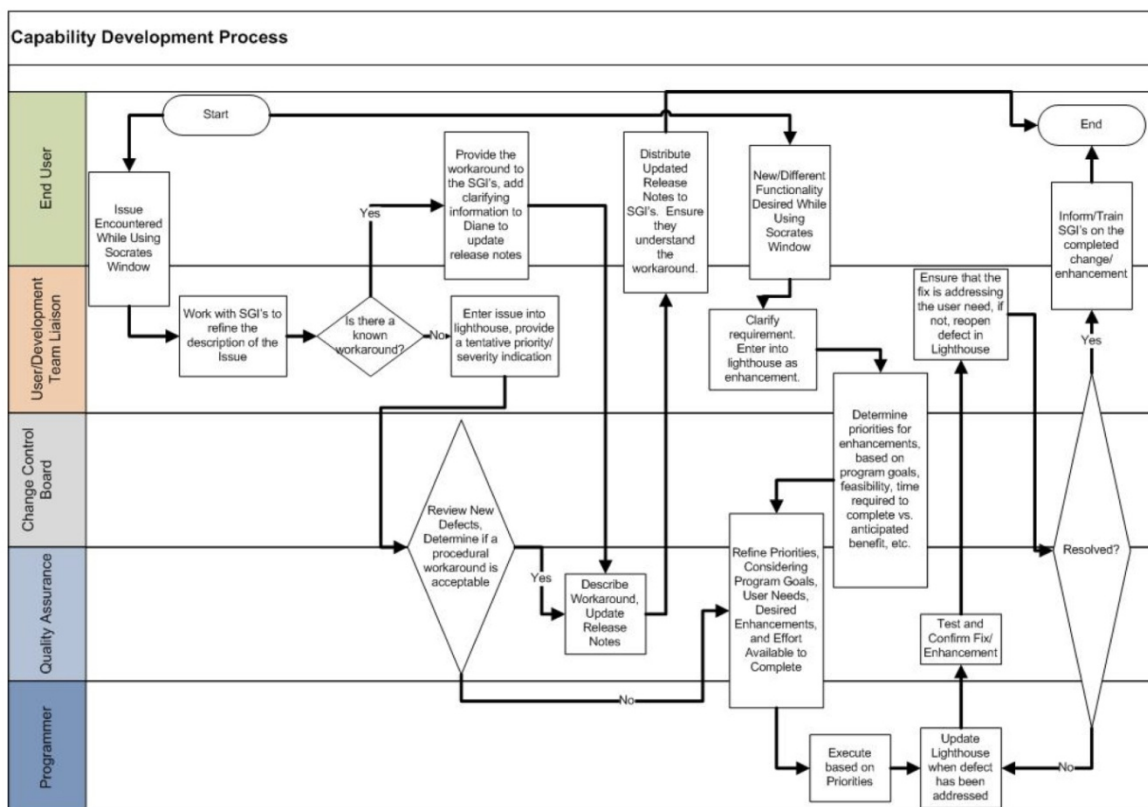
Figure 5. Tiered organization of the development team and the associated elements of the software development process.

Formal Systems Engineering

A software systems engineer was retained to help achieve a rigorous systems-engineering process of appropriate size and level of detail for the project. Part of the guidance was to utilize a formal systems engineering tool ("Lighthouse"). Various views in the Lighthouse portal are shown in Figures 6-10. The portal ensured tight coordination in the development team as the software was developed. The software development process was part of the overall spiral development in this project. During the formal tracking of software development, there was continual and intense use of the tool by members of the team on behalf of the MC3 SGIs. In particular, documents that were loosely organized independently by a number of SGIs were uploaded and organized in Socrates Window. This direct experience with various versions of the prototype enabled continuous usability engineering to maximize the utility of the tool.

Figure 6. Tracking versions in Lighthouse.

Figure 7. Traceable activities of development team in Lighthouse.

The objectives of the development process were:
- Hone in on the most simple and effective design of the interface with respect to providing outsiders with visibility and opportunities for influence.
- Intense use of the Socrates Window to embed team in the organization of MC3 materials and prepare interface for use by the MC3 SGIs.
- Refine user needs, based on actual use of the Socrates Window prototype, reviewed through change control before modifications implemented in accordance with associated change proposals.
- Stabilize the design through formal systems engineering configuration management that stops churn on requirements and helps manage scope.

Logout | Forum | Knowledge Center | Demo Center

LightHOUSE

SUMMARY   PROJECT   REPORTS   TIME   PREFERENCES   ACCOUNT   Search

Home   Tasks   Resources   Documents   Issues   Assessment   Notification   Change   Requirements   Testing   Defects

Defects | Modules | Release & Iteration | Builds   Project | Socrates' Window

New Defect | Edit Defect | Export | Select All | Deselect All | Create Change Request | Create Test Case

Filter | Unresolved Defects ▼ New | Edit | Delete | Make Default   Defect # [   ]   Find

Click on a column header link to sort and click again to reverse sort

	ID	Summary	Status	Resolution	Priority	Severity	Assigned To	Release
☐	11	Ease of Uploading Data - Document IDs are not necessarily mapped accurately	Open	None	P1	Normal	Gary Riccio	
☐	76	Special Events Administration - Values reset if invalid values entered	Open	Needs More Info	P1	Normal	Gareth Digby	
☐	91	There is no default date for special events	Open	None	P1	Normal	Yale Marc	
☐	95	Activities Associated with a Special Event Not Displaying on Day's Schedule	Open	Needs More Info	P1	Major	Gareth Digby	
☐	98	Special Events Navigation and Refresh	Open	None	P1	Major	Diane Miller	
☐	8	Ease of Uploading Data - Doctrinal Hierarchy of Operations	Reopened	Needs More Info	P2	Normal	Gareth Digby	
☐	32	Site Structure - No action that can back you out to the set of docs/experts for the topic	Reopened	None	P2	Normal	Yale Marc	
☐	38	Site Structure - Setup menu items and resulting windows titles should match	Open	None	P2	Normal	Yale Marc	
☐	88	Sent Messages tab incorrectly populates "Sent To" field	Open	None	P2	Normal	Yale Marc	
☐	96	Instructors Can't Add Events to Special Events	Open	Needs More Info	P2	Major	Rob Semmens	
☐	37	Site Structure - Data validation	Open	Needs More Info	P3	Normal	Gareth Digby	
☐	39	Site Structure - Field labels should be followed by colons	Open	None	P3	Normal	Yale Marc	
☐	40	Site Structure - Add spaces after weekend day and value	Reopened	None	P3	Normal	Yale Marc	
☐	57	Messaging - "new message" pop-up window keeps coming up	Open	None	P3	Normal	Yale Marc	
☐	66	Typo under Type of Offensive Opns	Reopened	None	P3	Normal	Yale Marc	
☐	80	Browser refresh problems	Open	Needs More Info	P3	Normal	Gareth Digby	
☐	87	Clicking on same day in calendar widget clears data on schedule display	Open	None	P3	Normal	Yale Marc	
☐	98	Minute Interval on Start/End Times	Open	None	P3	Enhancement	Gareth Digby	

Figure 8. Tracking potential software improvements in Lighthouse.

Logout | Forum | Knowledge Center | Demo Center

LightHOUSE

SUMMARY　　PROJECT　　REPORTS　　TIME　　PREFERENCES　　ACCOUNT　　Search

Home　Tasks　Resources　Documents　Issues　Assessment　Notification　Change　Requirements　Testing　**Defects**

Defects　Modules　Release & Iteration　Builds　　　　　　　　　　　　　　Project　Socrates' Window

*Required fields are marked with an asterisk **

[Customize this page]

ID	8	CDT	07/29/2008 06:07 (PM)
Reporter	Gareth Digby	MDT	08/14/2008 01:10 (PM)
Summary *	Ease of Uploading Data - Doctrinal Hierarchy of Operations		
Status *	Reopened	Resolution *	Needs More Info
Severity *	Normal	Priority *	P2
Build *	Version 0	Module *	Main
Platform *	PC	OS *	Windows XP
Assigned To	Gareth Digby	Fix Release	--- Select One ---

⊞　Depends On (0)　[Link]　　　　　　　⊞　Blocks (0)　[Link]

URL

Description　The highest level categories in the Doctrinal Hierarchy of Operations (Offense, Defense, Stability, Support) should not be selectable, nor should the explanatory headings (Forms of..., Types of...). We don't need to roll up documents/experts to this level. It also leads to the problem that an Expert who is associated with Peace Opns and only Peace Opns rolls up to Stability Operations which, if the latter is selectable, suggests that the Experts can speak to all types of Stability Operations. [GR A-006 2]

Prior Comments　--Comments from Yale Marc on 08/25/2008 at 09:19 pm
Just so I am clear and do this right please confirm you want the following links removed and that this constitutes all links that need to be removed:
1. Movement to contact
2. Attack
3. Retrograde operations
4. reconnaissance operations
5. Security operations
6. Troop movement

--Comments from Gareth Digby on 08/15/2008 at 02:21 pm
Defect reviewed by Rob and Gareth in v1.07.

On the Full Spectrum Ops tab/page, the topics are arranged in a hierarchy. For example, ENABLING OPNS <- RECONNAISSANCE OPERATIONS <- Zone. Or for example, ENABLING OPNS <- TROOP MOVEMENT <- Road March. Or for example, ENABLING OPNS <- PASSAGE OF LINES. Only the leaf nodes in the hierarchy shall be selectable. So in the above example, only Zone, Road March and PASSAGE OF LINES shall be selectable.
--Comments from Diane Miller on 08/14/2008 at 01:09 pm
Just re-checked this. The top half, "TYPES OF MILITARY OPNS" is OK, but the bottom half, "TYPES OF ENABLING OPNS" still needs to be fixed. You can select the "INFORMATION OPERATIONS" and "COMBAT SERVICE SUPPORT"

Note: assuming that the remaining headings (even those in all caps underneath, like "RECONNAISSANCE OPERATIONS" or "TROOP MOVEMENTS", should be selectable.

--Comments from Yale Marc on 08/05/2008 at 07:02 pm
v1.06

--Comments from Gareth Digby on 07/29/2008 at 08:29 pm
This issue has not been fully addressed. As requested, one cannot select a high-level category in the DHO when adding a new user (i.e., expert) BUT high-level categories still are selectable when viewed in the DHO window, and expert windows are still visible for these high-level categories. (GR, 27MAY08)

--Comments from Gareth Digby on 07/29/2008 at 08:28 pm
Feature Added (5/15/08 YM)

Comments

⊞　Linked Objects (1)　　　　　[Link]

Attachment	Name	Action
	No Attachments	
	Add Attachment	

Figure 9. Tracking change proposals for software in Lighthouse.

Figure 10. List of software changes in Lighthouse.

THE INNOVATION

Systems Engineering Description of Innovation

A software systems engineer was retained to develop an externally usable description of the innovation after two years of concept refinement and system development based on documentation of the R&D to that point in time and based on supplementary interviews with the development team.

JEM

The R&D for JEM sets out to provide a pedagogical framework to meet the needs of the expeditionary force. JEM has the pedagogical aim of teaching how the collection, exploitation and distribution of credible, valid and relevant intelligence (knowledge) can be performed. One of the tenets of JEM's pedagogical framework is the use of Socratic dialogue.

R&D seeks to determine the components of the constructs associated with JEM, the fundamental attributes embodied therein, the operational capabilities to which it is relevant, and the environments suitable to enhance ground component Expeditionary Mindset and the associated Joint capabilities[1]. This will be achieved through the development of a computer-mediated training environment that can be used to prepare ground component forces with the necessary cognitive skills for the emerging challenges of a Joint and Expeditionary force.

The key challenges associated with JEM are:

- Identification of the attributes of JEM that allow ground forces to counter the threats in the COE;
- Closing the gap between the COE and programs of training and education;
- Providing users and stakeholders with visibility into and opportunities for influence on development of the innovation;
- Assuring transition of the innovation into a specific program of training or education.

JEM is able to leverage a number of unique opportunities to provide an environment within which the problem can be more clearly characterized, the key challenges met and a solution developed, including:

- Currently there is an unprecedented abundance of expertise in expeditionary operations such as those associated with COIN;
- The MC3 has been updating its program of instruction based on guidance from TRADOC to emphasize challenges of COIN in the COE, and to balance offensive, defensive, stability operations;
- There is rapidly increasing interest and experience in Theater and in CONUS with web-based methods of sharing information and lessons learned about the COE.

---

[1] From 2005 solicitation of OSD under the Small Business Innovation Research program.

The solution envisaged for the JEM research project was an innovative integrated set of products and processes which make ECOEs accessible to students, helpful to instructors, and pedagogically prepared to participate in Socratic Distance Learning. The set of products and processes comprise of:

- An approach which blends classroom learning with web-based learning and is pedagogically well integrated into an established and relevant curriculum;
- A web-based capability which enables ECOEs to help instructors implement guided experiential learning in an established curriculum;
- A web-based capability that leverages best practices and lessons learned in knowledge databases and live on-line (i.e., synchronous) discussion in Theater and in the classroom.

JEM deals with the issues associated in providing training and education for an expeditionary force that must prepare for combat and non-combat operations while learning to improvise and adapt to constantly changing threats.

While the expeditionary force acknowledges that no one can ever be prepared enough, it can still prepare for a lack of preparation. Education is key tool in preparedness. Traditional education sees knowledge flowing from the top down. However in reality, knowledge flows from many directions. Students need to learn how to gather knowledge from multiple sources. Instructors need to learn how to identify the multiple sources. Both students and instructors need to learn how to disseminate which of the information flows contain relevant information. They must learn to learn. Given *Digby's Paradox*[2], both students and instructors need to develop the skills necessary to educate themselves and others to meet the needs of the expeditionary force.

Background

The COE is the phrase given to the environment the military finds itself operating in at any given moment. Historically the COE was perceived to be a non-urban location (the plains of Europe, the deserts of North Africa, the jungles of Southeast Asia) against another formal, standing, regular military force with both sides conducting traditional symmetrical warfare. The last few decades have seen the actual COE change to include, more often than not, an urban location against an irregular military force. Both sides are now engaged in an asymmetric conflict.

Tactics and procedures, often developed in the field, have allowed the regular military to engage and defeat irregular forces. However the irregular forces change their tactics on a continuous basis. Development of new tactics and procedures in the field has allowed the conventional military to remain in step with the evolution of the opponent's tactics.

The conventional military is a large organization with a formal structure. The traditional military training and education establishments teach in accordance with the needs of current doctrine. Doctrine is determined centrally within the military hierarchy. While the situation in

---

[2] Digby's Paradox: While data quantity and data delivery bandwidth increases, societal expectations are that the time available to perform tasks decreases. As a consequence, knowledge must be assimilated in smaller units of time and therefore useful knowledge becomes harder to obtain.

the COE is used in the determination of doctrine, the view observed by the hierarchy is only a snapshot in time for all the obvious reasons of management. By the time the snapshot of the COE has been used to update doctrine, the new doctrine used to developing teaching and teaching delivered, an amount of time will have passed. As a consequence, the students emerging from the educational process will enter a COE that bears no resemblance to the one they were taught about. As a consequence, additional knowledge must be passed on to them once they are in the COE.

The time delay in recycling knowledge from the COE back into the education environment is most pronounced in COIN operations. Also recent years have seen increased military involvement in Operations Other Than War (OOTW). This is still a changing environment with an evolving list of players including other governmental agencies (OGA) and non-governmental organizations (NGO).

The knowledge gap due to the time delay for COIN will revolve around the current tactics and procedures used by both sides in the COE. For OOTW the knowledge gap will revolve around the capabilities that OGA and NGO bring to the COE. In both cases local cultural knowledge about the COE may be missing from the formal training.

The Educational Setting

Formal continuing professional development is very much part of military doctrine. A military unit's operational state is juxtaposed with periods of exercise and training. Individuals in the military are trained and educated as they are promoted. Much of an individual's education takes place in formal educational establishments. Often the emphasis is on small group instruction with a significant amount of interpersonal interaction. A consequence of this is a geographically constrained community, which while open to insiders, is difficult for outsiders to gain access to.

Initial Vision

The present research investigated an operational architecture to allow the reduction in the time delay for knowledge transfer from the COE to the classroom (see Figure 3). The proposed operational architecture allows knowledge (hereafter collectively referred to as knowledge) to be transferred from the COE to the educational environment without it following the chain of command. A peer-to-peer structure is used to implement the operational architecture. The operational architecture relies on ECOEs to communicate knowledge to the instructors in the educational environment. The experts would be from either a military organization, OGO or NGO.

Development of the operational architecture revealed two needs: in order to be effective the expert would need visibility of the course content in order to ground their knowledge in the appropriate pedagogical context; those offering expertise need to be assessed to ensure they are bono fide and able to provide relevant knowledge.

In essence the operational architecture is for the provision of visibility of an insular domain to outside experts, in order to increase the tempo of knowledge exchange. The operational architecture allows for social interaction in the education domain.

Just as the educational establishment has its own ways of working, the expert's own organizations will have their ways of doing business. Therefore a solution cannot be prescribed across multiple organizations. The solution must be flexible.

Major Use Cases

Provide Visibility of Course Content. It is comparatively easy for a person to communicate knowledge to others. However for that knowledge to be effective and provide added value to the recipient, the knowledge should be delivered with reference to the context within which it will be used by the recipient. Therefore it was recognized that the provision of expertise would be more effective if the expert was able to understand the context within which their knowledge would be used and what had led to the need for that knowledge. The course objectives and the course content (slides, reading lists, documents and examples) go a long way to establishing the context within which the expertise will be used. Visibility of course content was also important to allow experts who had no knowledge of the course, or its structure, or educational techniques, to contribute.

Provide Expert Selection. While every person working within an environment will gain knowledge about that environment, it does not necessarily imply that that knowledge will be relevant to others or that it can be delivered in a meaningful manner. As a consequence, it is necessary to assess those offering their services as an expert. Rather than use the traditional recruiting cycle where the expert would prepare a resume that would be reviewed by the instructors, another approach was considered that would allow the instructors to ask the experts focused questions and then review the responses.

Refining the Operational Architecture

Improving the visibility to ECOEs also meant that visibility of the material to insiders such as the instructors and students could also be improved. However simply providing visibility to the course content in its existing silos would not be an effective mechanism to aid understanding for anyone. A method was needed for categorizing the content that implicitly showed the interconnections between categories. As an educational establishment operates on a calendar, it was also important to tie the content to its place in the academic year. This would be an aid for both students and instructors wanting to rapidly locate content associated with a particular teaching period. It also would provide outside experts with visibility into the temporal context for queries and needs, that is, issues of the day as well as considerations in immediately prior and subsequent lessons.

It was recognized that improving visibility also involved breaking down the "walls" around the education establishment to the experts who were geographically dispersed to gain visibility. A side effect of this would be to allow students to have visibility of material while not at the education establishment.

As well as being geographically dispersed, experts are likely to be located in different time zones. Therefore mechanisms for communication must be able to cope with this.

Systems Engineering Lifecycle

A spiral-based systems engineering life cycle has been adopted for the JEM program. This incremental and iterative development method offers a number of benefits for the JEM program:

- The system-of-interest is open to the insertion of new technologies. This is especially important with respect to web-based technologies where their development-cycle time either equals or is less than the length of the JEM program.
- A candidate system-of-interest can be rapidly developed and then assessed against the emerging user requirements.
- The user requirements can be gathered and validated as and when opportunities arise. The validated requirements can then be fed into the development process when they are available. This is more beneficial than having a large requirement to capture activity at the beginning of the program which results in a static requirement set for the duration of the program.
- The development spiral allows for the development candidate systems-of-interest in phase with the funding cycle.
- The iterative introduction of candidate systems-of-interest into the operational environment allows requirements of increased focus and fidelity to be captured on each iteration.

Integration, Verification and Validation Strategy

The integration strategy for the JEM research project allows for the integration of technology solutions with increasing fidelity in each iteration. For example, the Phase 1 candidate system-of-interest leveraged Web 1.0 technologies in order to draw out issues and constraints associated with the use of Web technologies within the educational environment. The next iteration of the candidate system-of-interest will use "Web 1¾" technologies (a subset of Web 2.0 technologies) that will be chosen to implement the requirements validated against the Web 1.0 candidate.

The validation strategy uses the iterative placement of candidate systems-of-interest into the education environment to provide a means by which the suitability of the original requirements can be measured (and hence validated). The validation of the requirements with a candidate system-of-interest in its operational environment allows, not only the requirements for the system to be validated but also requirements for the educational activities can be captured as the impact of the candidate system-of-interest becomes more obvious. This allows for smooth integration of the candidate system-of-interest into the operational environment.

Socrates Window

A number of different approaches are available to implement the operational architecture. The team chose to develop a prototype, Socrates Window, instead of purchasing commercial-off-

the-shelf (COTS) software that would be more difficult to tailor to user needs. Socrates Window provides visibility to the course content through web access to a document repository. The documents within the repository are categorized using: an ontology based on the hierarchy of military doctrine; a course syllabus; and course calendar. Socrates Window also provides an email-style messaging service to allow "time-displaced" communication.

Socrates Window is a product to support R&D in the JEM project. One of the tenants of JEM's pedagogical framework is the use of Socratic dialogue. A goal of Socrates Window is to provide a means of distance learning through a web-based Socratic dialog. Socrates Window is to support JEM's pedagogical aim of teaching how the collection, exploitation and distribution of credible, valid and relevant knowledge can be performed. As the research project is investigating a number of methodologies that will help solve the pedagogical needs of the expeditionary force, the implementation of Socrates Window needs to be flexible to allow the insertion (or removal) of features that support one or more of JEM's teaching strategies.

Identification of Emergent Properties

The introduction of candidate systems-of-interest into the educational environment and the subsequent monitoring of their use allows for the identification of emergent properties. The emergent properties may manifest themselves as unforeseen but beneficial uses of the system or changes in the ways-of-working for the instructors, experts, or students. The iterative development cycle allows the emergent properties to be identified and subsequently, if necessary, modifications to the system's requirements can be made in order to enhance the emergent properties.

Information Architecture

Ultimately the JEM research project is about the provision of information, in this instance to students from their instructors and associated experts. Interactions with users and stakeholders in the context of the candidate system-of-interest provided evidence that the appropriate management of information is key to the success of the JEM program. Further studies on the information architecture are being conducted. These include identification of appropriate meta-data for classifying and categorizing data, including the use of folksonomies and ontologies.

Security Architecture

In addition to the "traditional" information technology security measures for a military system, the R&D identified the need for those interacting with the system to be assigned "roles." At the broadest level the roles are instructor, student and expert. However initial findings indicate that the implementation of roles needs to be in a loosely restrictive manner. Further research is being conducted in this area.

In addition to the assignment of roles, the R&D recognized the need for assurance as to the identity of the people interacting with the system, in particular the experts. JEM and its system-of-interest, Socrates Window, change the educational environment from being a single point – the classroom – to a distributed environment. The distributed nature of this environment,

in particular, where the expertise is likely to be found, coupled with the notion that an expert may provide expertise to many different "communities" strains the traditional methods for verifying and validating the expertise provide by an expert. As a consequence further research is being conducted into digital identities and how they may help solve this problem.

Communications Architecture

At its most fundamental level, the Web is simply another means of communication. As such, not only does it provide communication but it also relies upon communication technologies. As the JEM research project is not just the provision of a software solution but also the provision of an approach to classroom learning, the other alternative communication mechanisms available to support the approach were also identified. Consequently the technologies required for the Web-based communication and the alternative communications mechanisms need to be brought together into a coherent communications architecture. Further research on the communications architecture is to be undertaken.

COTS Technologies Identification and Assessment

An ongoing project performed during each iteration of the JEM research project was the identification of commercial off-the-shelf technologies that could be leveraged in the provision of the system-of-interest. The research was performed in two ways: First, COTS technologies and solutions which could be used to implement a particular function or group of functions were identified in the system architecture. Second, existing websites providing community-based services were identified which exhibited one of more relevant functions. Then, if possible, the components used to implement these websites are identified.

Critical Dependencies between Major Item Developments

At the end of the project, dependencies between major item developments were identified. Dependencies between major items in the candidate system-of-interest and the education environment have also been identified.

Critical dependencies have been identified between the representation of the syllabus and the representation of a calendar for the course. The subsequent association of documents with the syllabus areas and calendar items has a dependency on the representation of the syllabus and calendar. These dependencies likely impact the implementation of the calendar application service and document management application service in the system-of-interest. The studies into the information architecture and the COTS technologies identification and assessment will help to mitigate risks associated with these dependencies.

Conclusions

Simplicity is the key but only if it is sufficient to *situate* the outside expert in the context of participants in the course and enable outsiders to act somewhat in the role of a *mentor*.
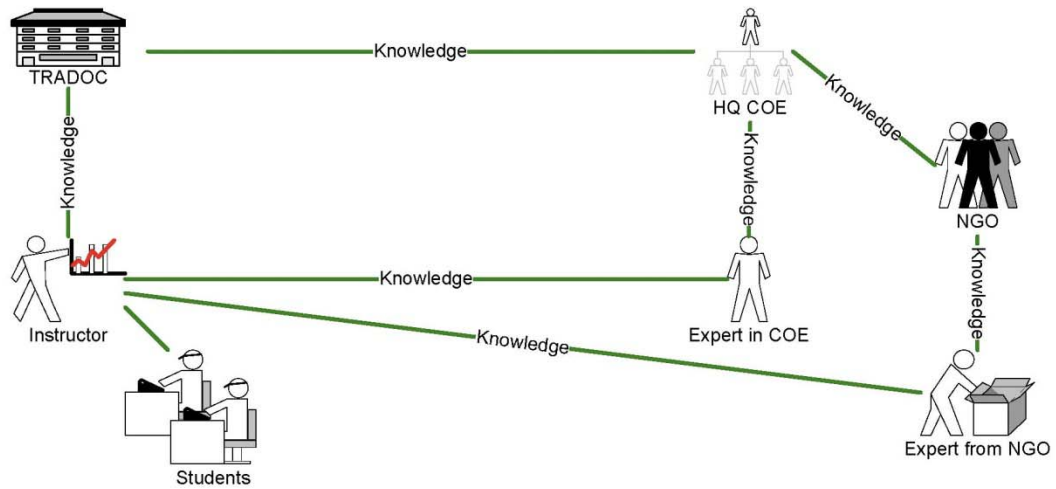
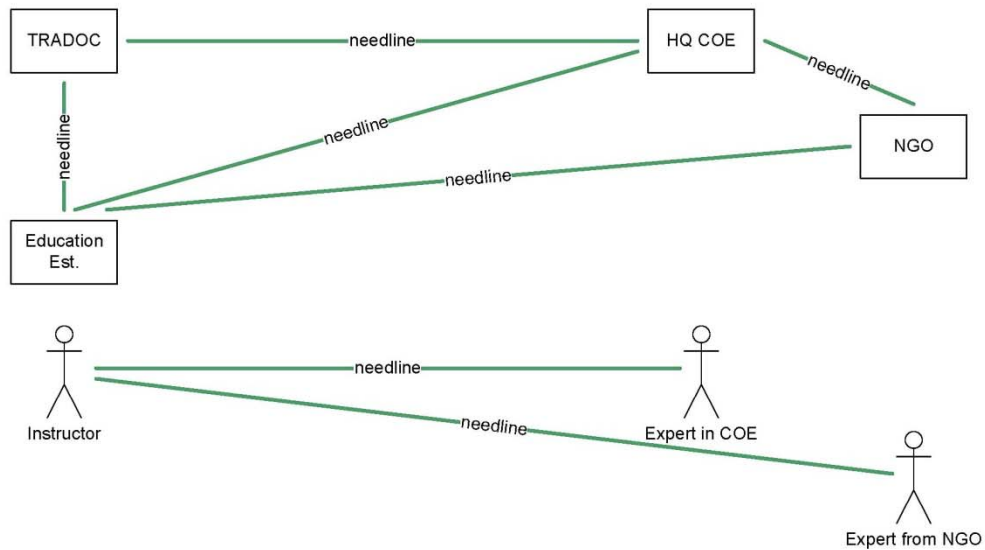Figure 11. OV-1 high-level operational concept graphic.

Figure 12. OV-2 operational node connectivity description.

OV-2

The needlines for a pre-JEM scenario are the same as the post-JEM scenario. Pre-JEM lines of communication were via a consolidation and aggregation via the chain of command in order to satisfy the needlines. The post-JEM scenario lines of communication map on to the needlines. The aggregation of knowledge is reduced as communication is direct (or as near as possible, direct).

Pre-JEM aggregation and consolidation introduced delays into the time taken to transfer knowledge – therefore the tempo is reduced. Will the post-JEM reduction in aggregation and consolidation activities give rise to saturation of knowledge going to the instructor, especially now the time delay is reduced and the tempo increased? Is tempo truly the inverse of time delay? Time delay implies a sequence of events whereas tempo implies and circular sequence of events.

Producer	Consumer	Information
Expert	Instructor	Knowledge on COE
Expert	Student	Knowledge on COE
Instructor	Student	Knowledge, course content, course context
Instructor	Expert	Question on COE
Student	Expert	Question on COE
Instructor	Expert	Question on experience
Expert	Instructor	Response on experience
Instructor	Expert	Course context
Instructor	Expert	Course content
TRADOC	Instructor	Course objectives, inc. doctrine
HQ COE	TRADOC	Knowledge on COE
Expert	HQ COE	Knowledge on COE

Figure 13. OV-3 operational information exchange matrix.
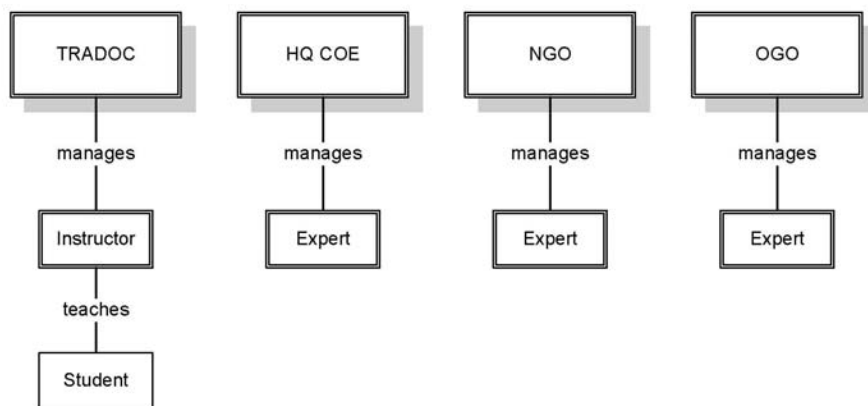
Figure 14. OV-4 organizational relationships.
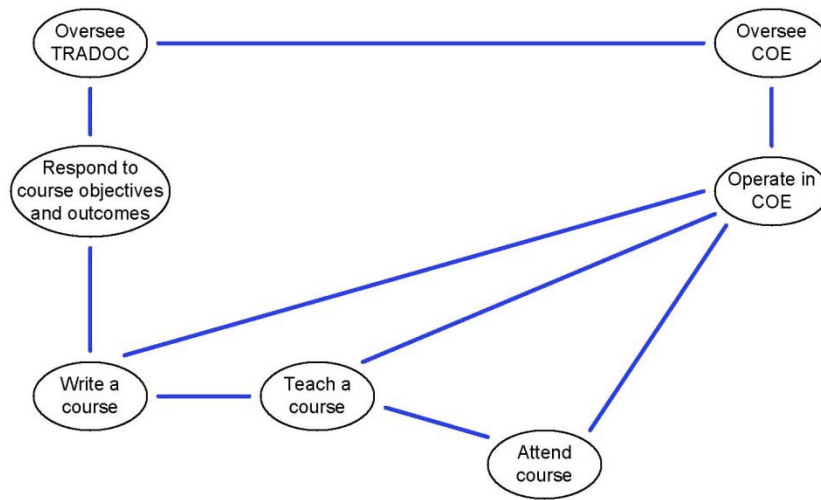
Figure 15. OV-5 operational activity model.

OV-5

The operational activities shown are the primary activities. Knowledge and experience is gained as a consequence of operating in the COE – rather than having the activity "gain knowledge." Similarly, the instructor uses the knowledge when writing the course – rather than through the activity "use knowledge."

OV-6

The OV-6 has intentionally been left blank at this stage. Adding detail to the OV-6 will introduce a "sequence of events" which at this stage we do not want to stipulate as it may imply a constraint on the interactions between actors.
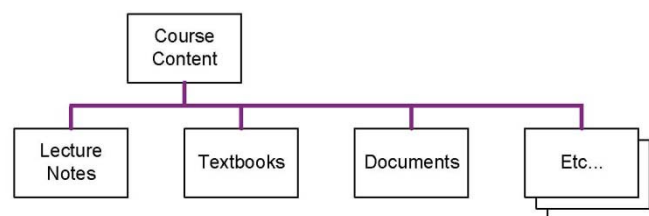
Figure 16. OV-7 logical data model.
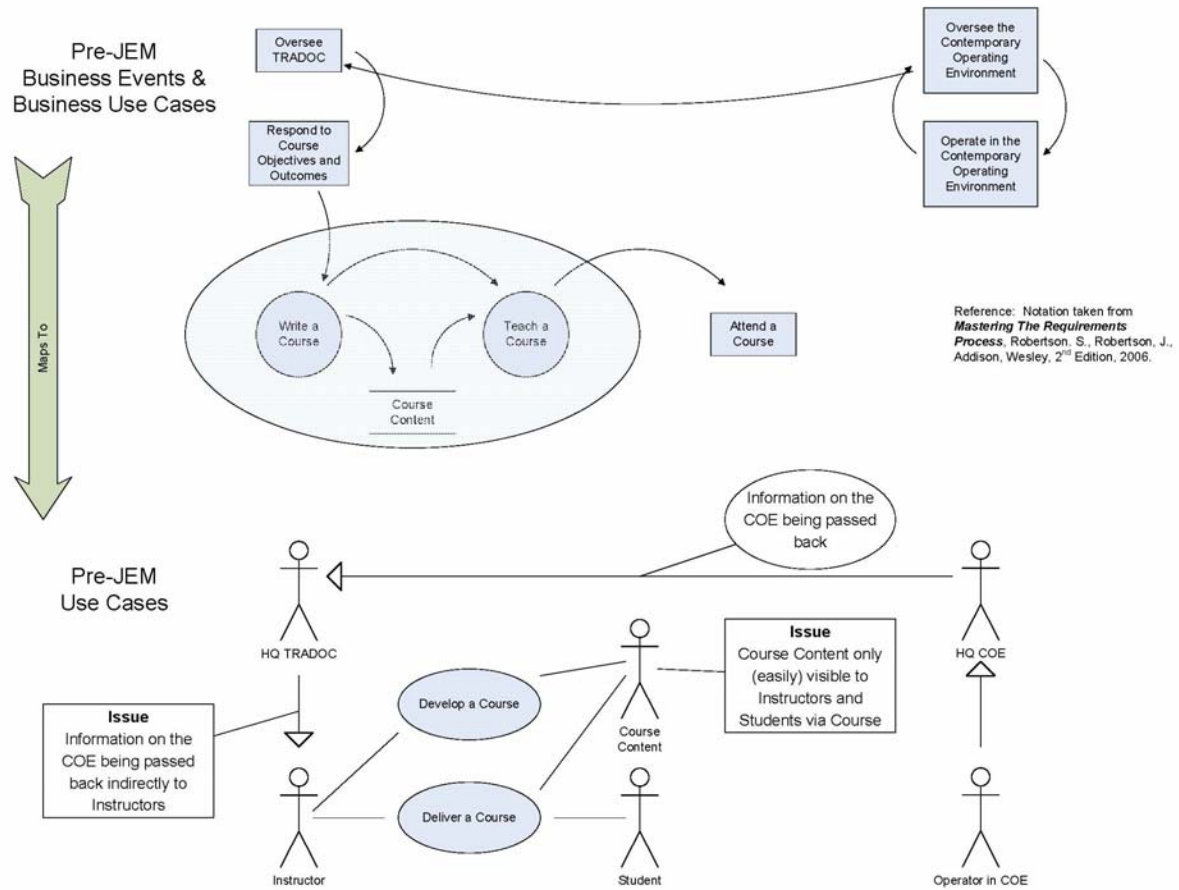
Figure 17. Pre-JEM use case.
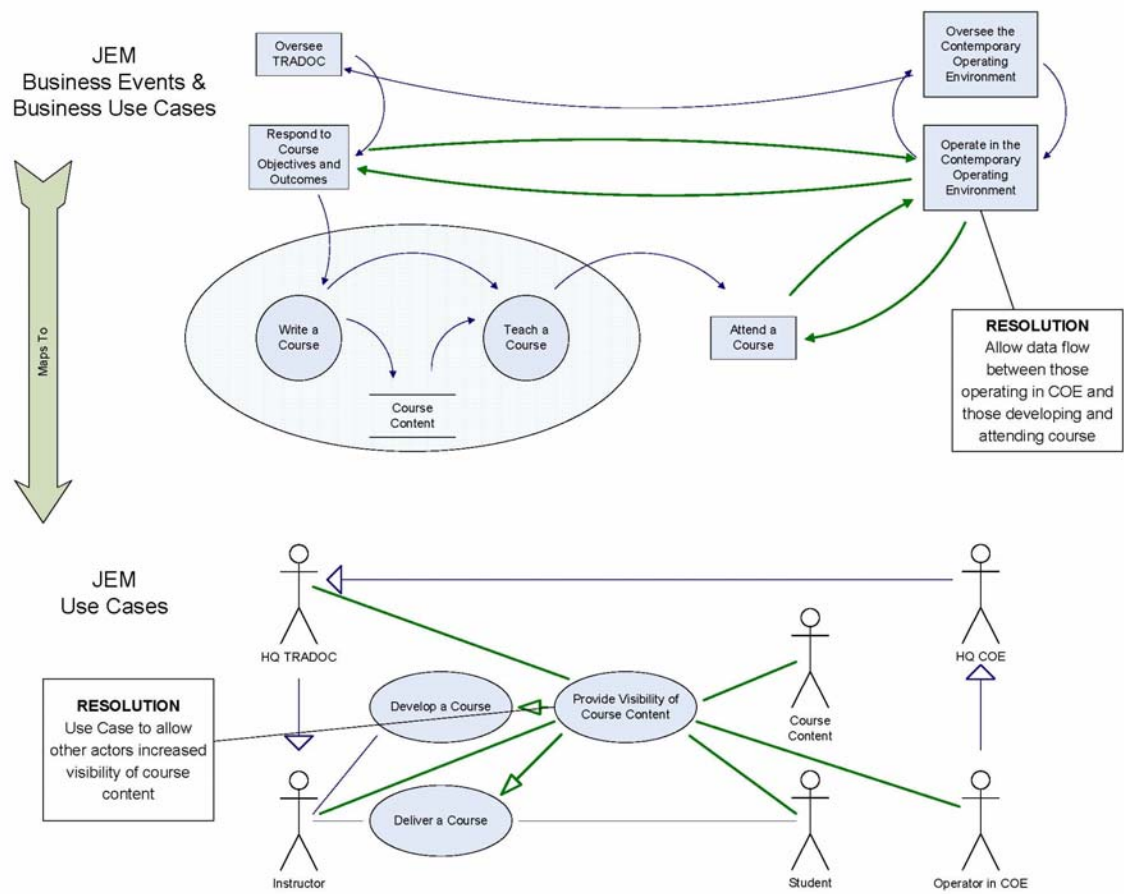
Figure 18. JEM use case.

Tangible Prototype: Socrates Window

A prototype was produced to guide the development of requirements for the innovation and to ground the usability engineering assessments of the innovation in the context of Army education. Simplifying the portal was a high priority in order to achieve the objective of expeditiously situating an outsider in the context of a course such as the MC3. Views accessible within the portal are shown in Figures 19-21.
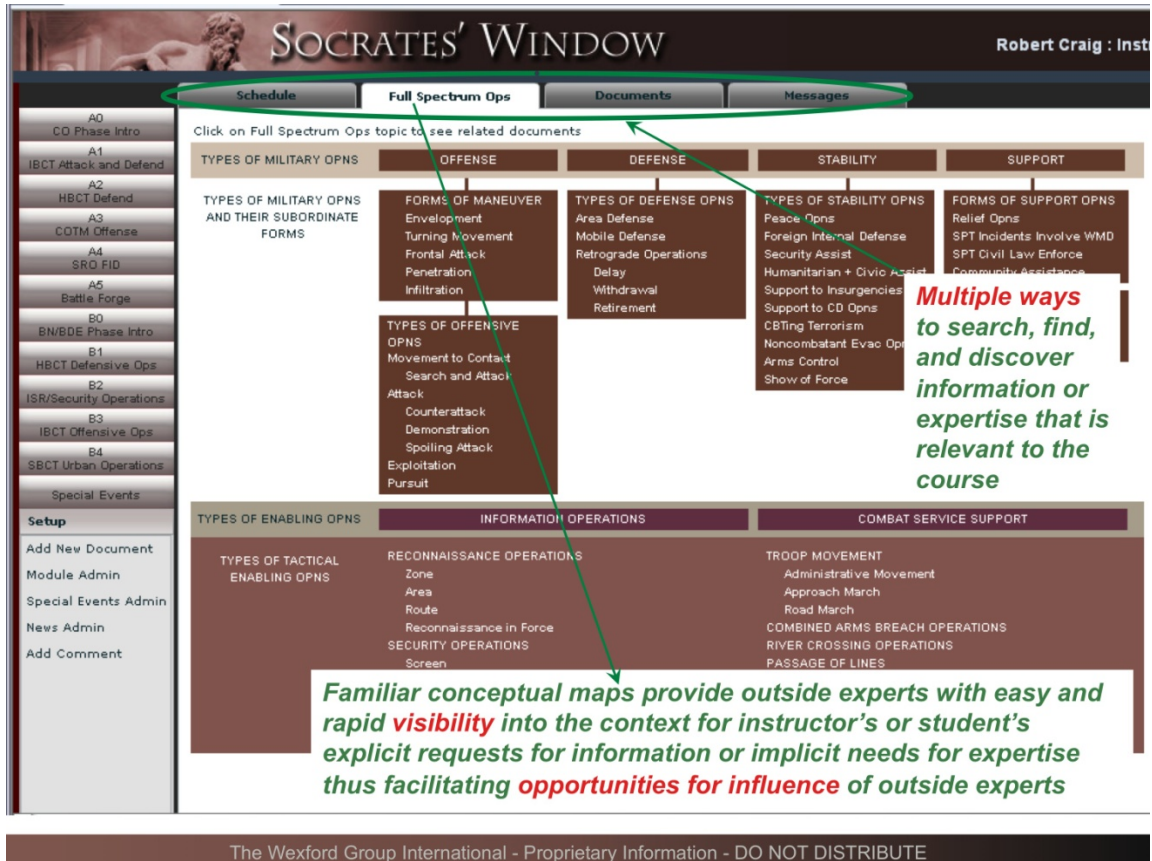
Figure 19. Utilize a familiar conceptual construct such as the doctrinal hierarchy of operations for Full Spectrum Operations as one of a small number of views as points of entry into the MC3.

Figure 20. Showing the course calendar is a best practice in web-based learning.

Figure 21. List of documents used in the course.

Best Practices in Selection of Elite Personnel

A COTS solution is recommended for selection of outside experts. In particular, the web-based capability offered by AccuHire Inc. was utilized in the JEM project. In addition to its use in the commercial sector, this portal and the associated process have been utilized for a number of years in selection of the world's most elite military personnel. The process utilizes highly targeted questions that get directly at a candidate's actual experience. The questions and the on-line answers the candidates provide are utilized in a subsequent behavioral interview that focuses simultaneously on the details and meaning of a candidate's actual experience.
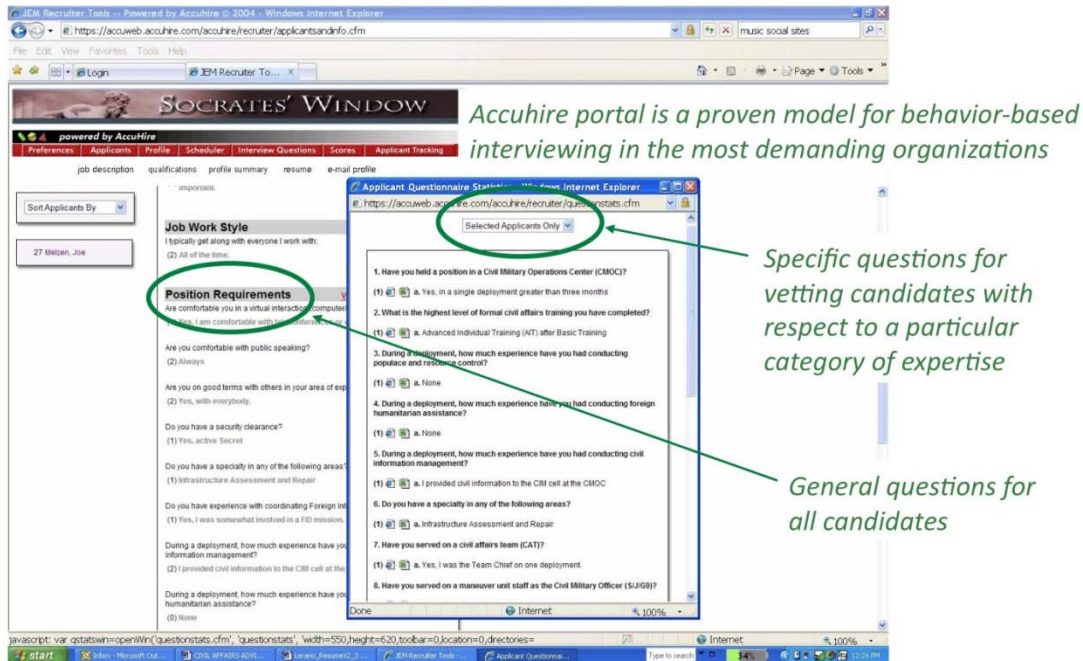
Figure 22. AccuHire website prototyped for Socrates Window.

The following needs for outside expertise in the MC3 were identified:
- Interagency Operations Advisor
- Civil Affairs Advisor
- Coalition Military Advisor
- COIN Operations Advisor
- Legal (e.g., JAG) advisor
- Policing Operations (e.g., MP) Advisor
- Information Operations Advisor
- Human Terrain Teams (Religious/Ethnic/Cultural Advisor)
- Human Intelligence (HUMINT) Advisor
- Signals Intelligence (SIGINT) Advisor
- Engineering Infrastructure (e.g., municipal systems) Advisor
- Improvised Explosive Device (IED) Advisor
- Distance Learning Expert

- Education Consultant

Utilizing the AccuHire process, position descriptions were developed for two important areas of outside expertise:

Interagency Advisor

- Experience working in the Inter-Agency environment, planning, executing, coordinating and synchronizing the efforts of multiple government agencies.
- Experience serving on a Joint Inter-Agency Task Force
- Experience serving as a Liaison Officer in a government agency other than your own
- Experience as an exchange officer in a school or assignment of a government agency other than your own

Civil Affairs Advisor

- A Civil Affairs Advisor has expertise in exercising the relationship between military forces and the civil component, including nongovernmental or intergovernmental organizations in areas where military forces are present.
- The civil affairs advisor may also involve the application of Civil Affairs expertise in areas normally the responsibility of the civilian government.
- Additionally, the civil affairs advisor has experience with not only tactical issues, but also Combat Support and Combat Service Support issues, host nation support and care of displaced civilians. S/he has done analysis regarding the impact of operations on public order and safety, the potential for disaster relief requirements, noncombatant evacuation operations, emergency services, and protection of culturally significant sites.
- The Civil Affairs Advisor provides feedback in how the culture in the AO affects operations. S/he is familiar with the civil considerations (areas, structures, capabilities, organizations, people, and events).

Behavioral Interview

Interactions with outside experts after use of Socrates Window led to the conclusion that a revealing format for the behavior interview could include collaborative development of tactical decision exercises (TDE) with outside experts, especially to the extent that the TDE bring all parties in the "interview" to the brink of what is known to them.

FOCUS GROUPS AND COLLABORATIVE REFLECTION WITH OUTSIDE EXPERTS

This stage of our usability engineering process was initiated once design of Socrates Window was stabilized through systems engineering change control and configuration management. Two major groups of experts were utilized in usability trials with Socrates Window: (a) personnel from the Army Center for Enhanced Performance (ACEP) who had relatively little knowledge of Army operations, and (b) personnel associated with the Army Air Defense community who were knowledgeable about Army operations but from a different specialty relative to the MC3. The fundamental query of these outside experts was whether and to what extent Socrates Window provides outsiders with expeditious visibility into the MC3 sufficient to reveal their opportunities for influence on MC3?

Outside Experts from Army Center for Enhanced Performance

There were two objectives of this first focus group with outside experts. First, we wanted to assess the efficacy of Socrates Window in an extreme case of outside experts with relatively little knowledge of Army operations, Army education, and the MC3 in particular. Second, we wanted to explore the technique of collaborative reflection in a focus group format for a usability engineering assessment.

Questions Addressed
- What degree of understanding of the MC3 and Army operations did ACEP users gain from utilizing Socrates Window?
- What of value to the MC3 do they think they could contribute from their area of expertise?

Method
- Trials conducted in February 2009
- Participants included five Performance Enhancement Specialists
    - Ph.D. or M.S. in Sports Performance/Psychology
    - Experience working with Soldiers ranged from 6 months to 2 years.
- Experts given some experience in using Socrates window
- Collaborative working group to address utility of Socrates window

Findings from outside experts

- The outside experts quickly were able to get oriented to the course and identify places where their expertise might be useful.
- Acronyms can be a large inhibitor to creating the desired visibility.
- An overview of the arrangement of the course would be helpful in orienting non-military experts. While the outcome goals listed for each module are useful, a higher level orientation that included a description of the students and their experiences, and the intent of the course, would help outside experts operate more autonomously in determining where their expertise could be of value.
- The technique of collaborative reflection should be developed further and employed as a means to conduct a condensed contextual inquiry in usability engineering assessment.

Design implications

- SGIs may have to make some additional effort to allow outside experts visibility into their course. A short description of each class, and limiting the use of acronyms in the software tool would seem to offer the greatest benefit to outsiders.
- While these steps may not be fully embraced by SGI, they will hopefully see the additional benefit of better situational awareness by outside experts. Additionally, they will have fewer inquiries about what is being taught, and more productive dialogue about how to improve the subject matter.

Outside Experts from Air Defense Community

Purpose

Given rapid changes in the COE, along with incremental development toward operating as a more expeditionary force, the need is increasing for the U.S. Army warfighter to quickly recognize, catalogue, share experience, and update classroom material to increase in its relevance. This increase in the rate of change affects training requirements for both novice and experienced Soldiers, forcing training to incorporate increases in level of interaction, change, and complexity. Specifically, these increases force instructors to develop timely teaching points that rest on solid doctrinal foundations while addressing current issues.

As the primary goal of the Socrates Window conceptual learning environment is to provide capabilities that support interactions between students and the ECOEs, under the control of a SGI, the purpose of this analysis was to further uncover measures of utility for this conceptual program. Specifically, this analysis was designed to collect and codify some of the opinions of military SMEs on the fitness of the Socrates Window concept for use in the Captain's Career Course (CCC), as well as their determinations of the "practical value" of this conceptual technology for use in the CCC instructional format.

Framework for Assessing Value

Broad Questions for Interview
(1) Where and how can the MC3 benefit from what you know about your specialty?
(2) Where and how can the MC3 benefit from what is taught in your course?
(3) Where and how can your course benefit from what is taught in the MC3?

Broad Questions for Interview with "Thought Probes"
(1) Where and how can the MC3 benefit from what you know about your specialty?
- Thought Probe(s):
  - Ask the interviewee to consider how an Air Defense Expert's knowledge of types of Air Defense systems might be useful to the MC3.
  - Ask the interviewee to consider how an Air Defense Expert's knowledge of the general system capabilities Air Defense systems might be useful to the MC3.
  - Ask the interviewee to consider how gaining an understanding of Air Defense systems capabilities might be useful to MC3.

- System capabilities: traditional uses
- System capabilities: non- traditional uses
- System limitations
  o Ask the interviewee to consider how knowing the general requirements to employ an Air Defense system (most efficiently) might be useful to MC3.
    - In terms of "Scheme of maneuver" (Course of action)

(2) Where and how can the MC3 benefit from what is taught in your course?
- Thought Probe(s):
  o Ask the interviewee to identify the "top 3 to 5" most critical pieces of information taught in the Air Defense course.
  o Ask the interviewee to explain/think about how this information can improve/enhance the MC3.

(3) Where and how can your course benefit from what is taught in the MC3?
- Thought Probe(s):
  o Ask the interviewee to consider their personal experience and then name the "top 3 to 5" most critical omissions from, or discrepancies taught in the Air Defense course.
  o Ask the interviewee to explain/think about how adding this information can improve/enhance the MC3.
  o *(Based on their review of the website, ask the interviewee to think about the information that is taught in the MC3 and identify concepts that could improve/enhance the Air Defense course?)*

Method

Interview participants. The SMEs interviewed for this analysis were Air Defense Artillery (ADA) Officers with a wealth of experience, ranging from 12 to 18 years of active-duty military service within the U.S. Army. These knowledge elicitation interviews were conducted on October 16, 2009. There were two interview sessions, with two SMEs present in each session (there was a total of 4 SMEs interviewed for this effort). The interview team consisted of four interviewers; with three of these interviewers calling in from locations across the country, and the remaining interviewer was co-located with the SME in Colorado Springs, CO.

Procedure and analysis. For the current knowledge elicitation, all observations were conducted by a four-person interview team to ensure coverage and responsibility for each of the primary interview tasks. These tasks include asking the primary thought questions, considering question redirects and follow-ups, taking notes, and keeping the discussion relevant to the intended topic. While all members of the interview team took some notes, the primary note taking responsibility was borne by one interview team member. Following the interview, this team member performed the following actions: (1) aggregated all of the notes taken from each interview session, (2) identified overlapping content, (3) resolved all conflicting information, (4) created a primary interview 'notes' repository, and (5) performed a thematic analysis of the newly created interview 'notes' repository.

The type of thematic analysis used in the present research was categorical in nature. Using the original proposal for this technological concept evaluation as a guide, a series of categorical themes were identified as being critical assessment points in determining to the effectiveness and applicability of the Socrates Window technology. These over-arching categorizations were (1) the primary utility for technology like Socrates Window, (2) information that can be taught/enhanced with Socrates Window, and (3) main concerns with the implementation of conceptual learning environment technology like Socrates Window. Once these themes were identified, the interview transcripts were reviewed and the textual elements that fit each of these categorizations were extracted and aggregated across sub-categories.

Thematic analysis of notes. The SMEs interviewed for this analysis generally found a good measure of utility to be associated with the concept of the Socrates Window learning environment, in addition to the technological implementation with which they were presented. The SMEs explicated the applicability of the concept and "value added" of this technology by providing their general impressions of the tool, considering the projected uses for the tool, and then considering situations (and/or types of information) for which the tool could optimally be used to convey expertise.

Specifically, beyond the conveyance of a specialty area knowledge (associated with a mission occupational specialty - MOS), the SMEs interviewed for this effort indicated the following primary uses for the Socrates Window:
- Unit Capability and Compatibility
- Enhance/Encourage Mission Adaptability
- Encourage "Out-of-the-Box" thinking
- Encourage Critical Thinking
- Operational Considerations/Needs
- Tying doctrine to operational examples
- Sharing OPFOR/insurgent responses to Army TTPs taught in class

A second, more detailed thematic analysis was performed on the transcribed notes for the purpose of identifying the specific categories of information that the SMEs felt could be taught, and or enhanced, through the use of the Socrates Window learning environment. More specifically, this second thematic analysis was designed to highlight the particular topics, subject areas, and/or types of information that could be trained through the use of Socrates Window. These categories were identified from the explicit examples provided by the interviewed SMEs, as well as through careful analysis of the comments and examples made by the SMEs when providing contextual relevance to their answers during the knowledge elicitation sessions.

The themes are listed in order of frequency of occurrence/mentioning.
1. System Capabilities (7)
2. Personnel Capabilities (6)
3. Tactical information (3)
4. Administrative/Logistical (3)
5. Case Studies and Applications of Doctrine (1)
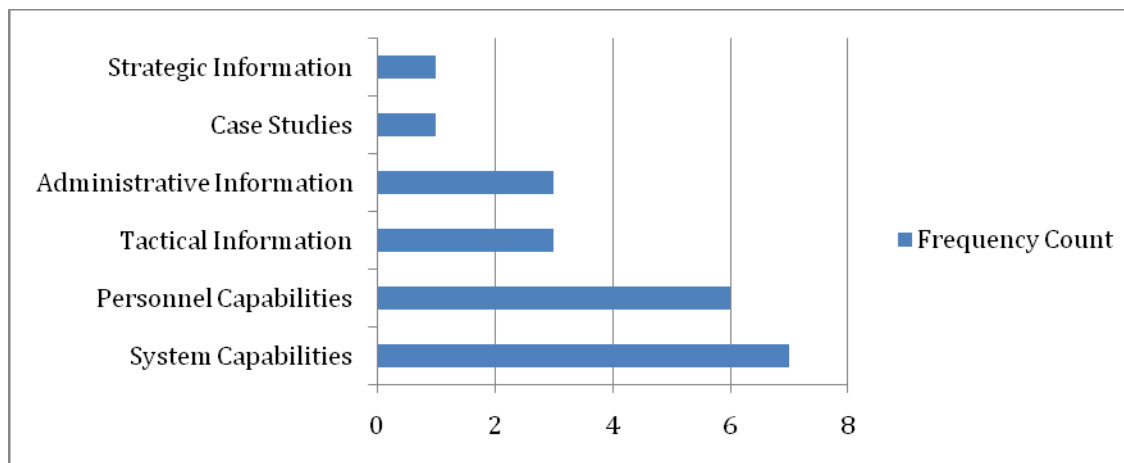6. Strategic information (Planning) (1)

Figure 23. Table of information best conveyed through Socrates Window.

Although all of the SMEs agreed that Socrates Window has many benefits for use in classroom environments (such as the MC3), and when used primarily in a supporting or supplementary role, each SME pointed out that such technology would only be useful to SGIs and the Soldiers in these courses if the tool didn't require an inordinate/exorbitant amount of effort to use. The specific concerns addressed by the SMEs were:

- Amount of time to collect and integrate outside expert feedback
- Amount of time necessary to vet outside expert feedback
    - Vet for content
    - Vet for accuracy
    - Vet for situational applicability
    - Vet for legality

Measures of Use

We utilized a COTS product, *Google Analytics*, to monitor and quantify the use of Socrates Window during our software development and demonstration (see Figures 24-28). The purpose was simply to explore its utility as a measure of use. We recommend bundling a capability like Google Analytics with Socrates Window.
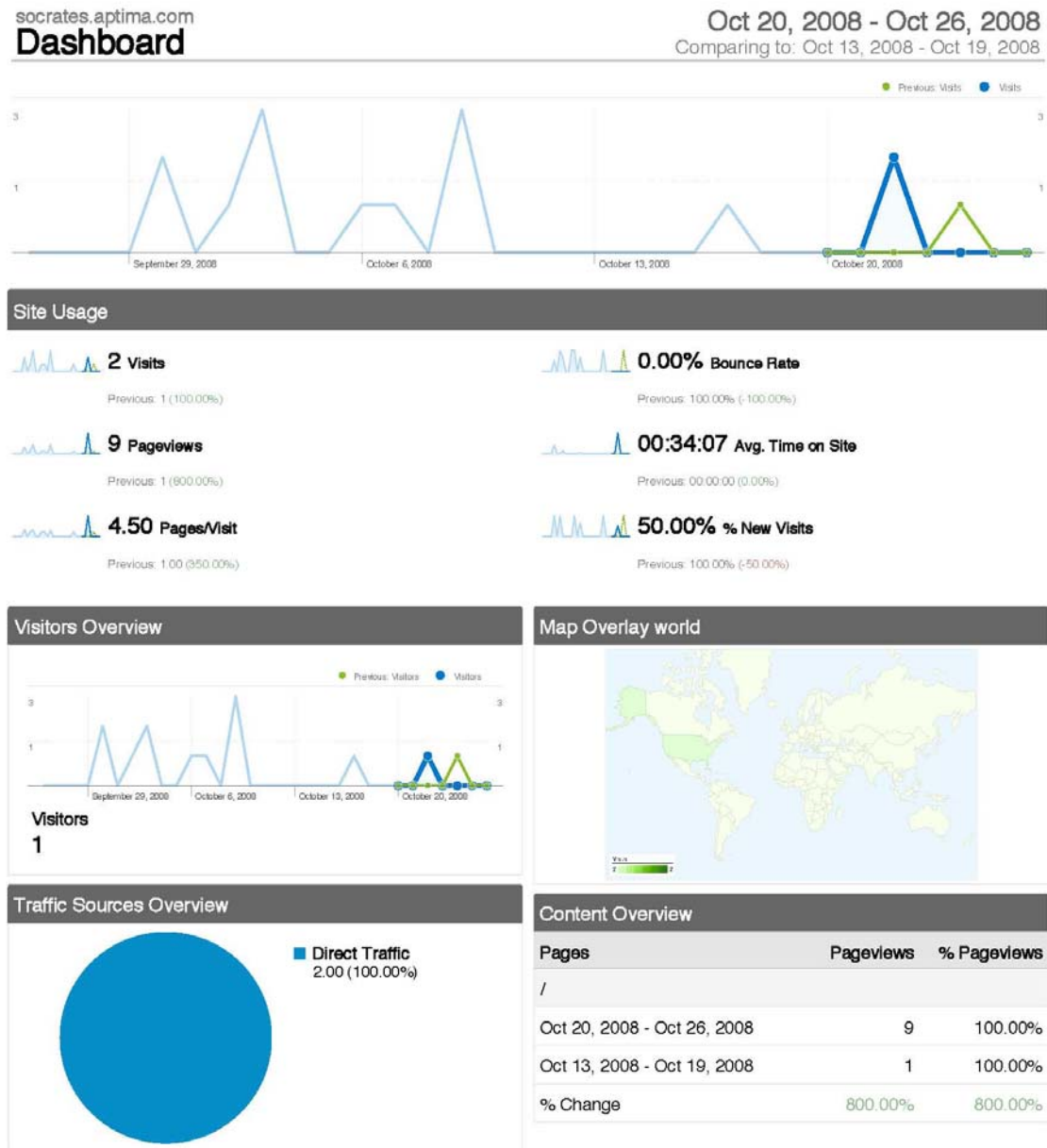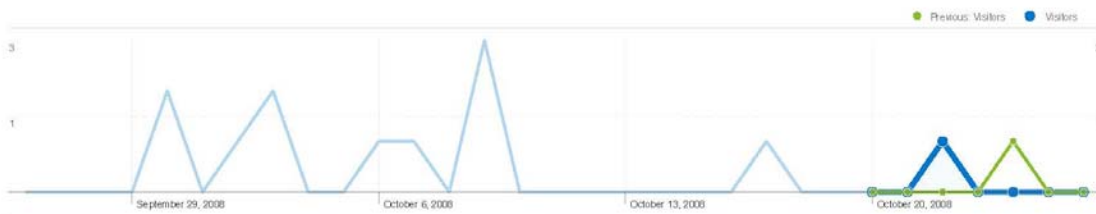

Figure 24. Measures of use from Google Analytics – site overview.

● Previous Visitors ● Visitors

September 29, 2008   October 6, 2008   October 13, 2008   October 20, 2008

1 people visited this site

2 Visits
Previous: 1 (100.00%)

1 Absolute Unique Visitors
Previous: 1 (0.00%)

9 Pageviews
Previous: 1 (800.00%)

4.50 Average Pageviews
Previous: 1.00 (350.00%)

00:34:07 Time on Site
Previous: 00:00:00 (0.00%)

0.00% Bounce Rate
Previous: 100.00% (-100.00%)

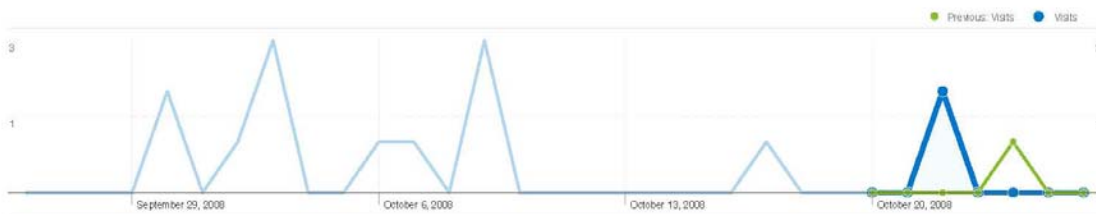**50.00%** New Visits
Previous: 100.00% (-50.00%)

Technical Profile

Browser	Visits	% visits	Connection Speed	Visits	% visits
Internet Explorer			Unknown		
Oct 20, 2008 - Oct 26, 2008	2	100.00%	Oct 20, 2008 - Oct 26, 2008	2	100.00%
Oct 13, 2008 - Oct 19, 2008	1	100.00%	Oct 13, 2008 - Oct 19, 2008	1	100.00%
% Change	100.00%	100.00%	% Change	100.00%	100.00%

Figure 25. Measures of use from Google Analytics – people visited.

46

Figure 26. Measures of use from Google Analytics – traffic sources overview.

Map Overlay

Visits

2   2

2 visits came from 1 countries/territories

Site Usage

Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
2 Previous: 1 (100.00%)	**4.50** Previous: 1.00 (350.00%)	**00:34:07** Previous: 00:00:00 (100.00%)	**50.00%** Previous: 100.00% (-50.00%)	**0.00%** Previous: 100.00% (-100.00%)

Country/Territory	Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
United States					
October 20, 2008 - October 26, 2008	2	4.50	00:34:07	50.00%	0.00%
October 13, 2008 - October 19, 2008	1	1.00	00:00:00	100.00%	100.00%
% Change	100.00%	350.00%	100.00%	-50.00%	-100.00%
					1 - 1 of 1

4   Google Analytics

Figure 27. Measures of use from Google Analytics – traffic sources countries.

48

Figure 28. Measures of use from Google Analytics – pages viewed.

PHASE III – ENHANCING VALUE THROUGH PEDAGOGY FOR BLENDED LEARNING

The triad in Figure 29 is a core innovation—a derived requirement—that motivates and guides innovation in all elements of the developing integrated capability. The most fundamental insight about this triad is that the intent for outside experts is to reveal the *values*, broadly considered, of the culture with which Soldiers in a particular branch must integrate to achieve the JEM necessary to operate effectively and adaptively in full-spectrum operations.
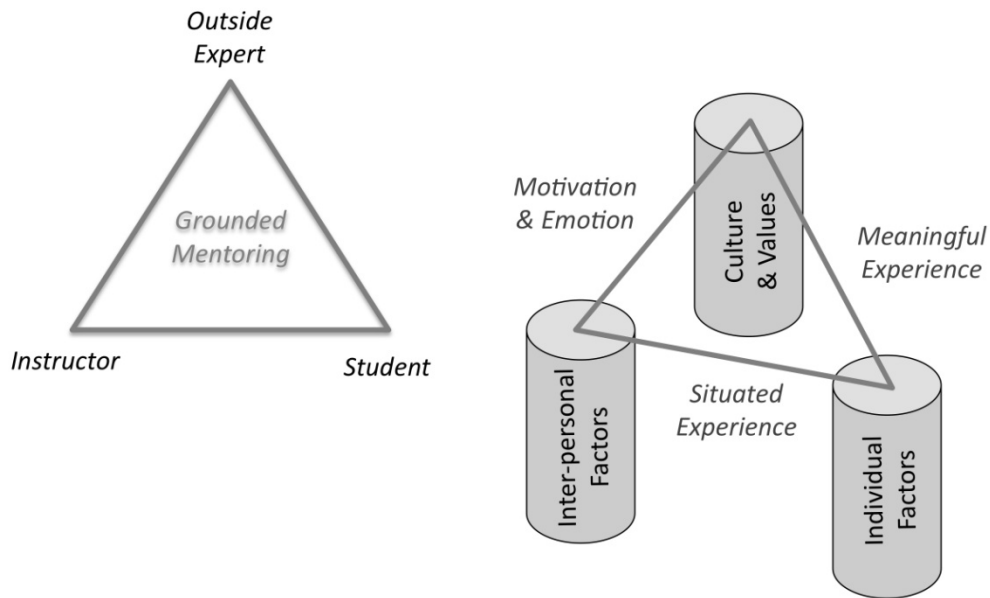

Figure 29. Framework for science to support development of pedagogy for blended learning.

This was a fundamental insight because one cannot expect to develop or acquire an effective distance-learning capability or blended-learning capability without first having a comprehensive scientific foundation for the pedagogy with which the educational technology must be consistent. This *pedagogy must be relevant to the Army*. Relevance in this respect is more than about utilizing methods of adult education. Programs of education outside the Army may be able to pay lip service to values-based requirements and the associated development of individuals but this is a gravely serious matter in the Army as an organization, and it has existential significance to Soldiers and their families. We recommend that further research be conducted to identify and develop an appropriate pedagogy for values-based education in the Army. We believe the central innovation of JEM, to link cultural insiders with experts from a different culture, provides a source of relevant case studies for development and assessment of values-based approaches to Army training and education.

REFERENCES

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W.H. Freeman.

Beale, R., Courage, C., Hammontree, M., Jain, J., Rosenbaum, S., Vaughan, M., & Welsh, D. (2008, April). Longitudinal usability data collection: Art versus science? *CHI 2008 Proceedings*, 2261-2264.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience, & school*. Washington, DC: National Academy Press.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*, 32-41.

Camic, P.M., Rhodes, J.E., & Yardley (Eds.) (2003). *Qualitative research in psychology: Expanding perspectives in methodology and design*. Washington DC: APA.

Carroll, J., & Rosson, M. (2007). Participatory design in community informatics. *Design Studies, 28,* 243-261.

Chairman of the Joint Chiefs of Staff (2004). *Joint Capabilities Integration and Development System.* Retrieved November, 2004, from Defense Technical Information Center Web site: http://www.dtic.mil/cjcs_directives/cdata/unlimit/3170_01.pdf.

Clarke, R. E. (2004). *Design document for a guided experiential learning course*. Los Angeles, CA: Institute for Creative Technologies.

Denzin, N.K, & Lincoln Y.S. (Eds.) (2003). *Strategies for qualitative inquiry*. Thousand Oaks, CA: Sage.

Defense Acquisition University (2003). *DoD business transformation.* Retrieved November, 2004, from DAU website: http://www.dau.mil/homepage%20documents/DoD_Business_Transformation.ppt

Department of Defense (2003). *Joint Operations Concepts.* Retrieved November, 2004, from Defense Technical Information Center Web site: http://www.dtic.mil/jointvision/secdef_approved_jopsc.doc

Department of Defense (2004a). *Joint Functional Concepts.* Retrieved November, 2004, from Defense Technical Information Center Web site: http://www.dtic.mil/jointvision/jointfc.htm

Department of Defense (2004b). *Joint Operating Concepts.* Retrieved November, 2004, from Defense Technical Information Center Web site: http://www.dtic.mil/jointvision/joc.htm

Friedman, B., Kahn, P., & Borning, A. (2009?). Value sensitive design and information systems.

In P. Zhang & D. Galletta (Eds.), *Human-Computer Interaction in Management Information Systems: Foundations.* New York: M.E. Sharpe.

Gibson, E. J. (1991). *An odyssey in learning and perception*. Cambridge, MA: MIT Press.

Gibson, J. J. (1977). The theory of affordances. In R. Shaw & J. Bransford (eds.), *Perceiving, acting and knowing*. Hillsdale, NJ: Erlbaum.

Kantner, L., Sova, D., & Anschuetz, L. (2005). Organizing qualitative data from lab and field: Challenges and methods. Usability Professionals Association.

Kerr, B. (2006, May). *BCKS wins knowledge management awards.* Retrieved August, 2006, from the TRADOC News Service Web site: http://www.tradoc.army.mil/pao/tnsarchives/may%202006/050406-2.html

Kilcullen, D. (2006). *Twenty-eight articles: Fundamentals of company level counterinsurgency.* Retrieved August, 2006, from the Joint Information Operations Center Web site: http://www.au.af.mil/infoops/iosphere/iosphere_summer06_kilcullen.pdf

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. New York, NY: Cambridge University Press.

Lewin, K. (1948). *Resolving social conflicts: Selected papers on group dynamics.* In G. W. Lewin (Ed.). New York: Harper & Row.

Markley, J. (2007). *The Army Distributed Learning Program Overview*. Paper presented at the 6th Annual ATSC dL Workshop. Williamsburg, VA.

Meigs, M. C. (2003). Unorthodox thoughts about asymmetric warfare. *Parameters, 33(2),* 4-18.

PBS Frontline (2005, Feb). *A company of Soldiers*. Retrieved April, 2006, from the Public Broadcasting System Web site: http://www.pbs.org/wgbh/pages/frontline/shows/company/lessons/

Petraeus, D. H. (2006). Learning counterinsurgency: Observations from soldiering in Iraq. *Military Review,* Jan-Feb, 2-12.

Reddish, J. (2007). Expanding usability testing to evaluate complex systems. *Journal of usability studies, 2(3),* 102-111.

Riccio, G., Lerario, M., Cornell d'Echert, B., Pound, D., Brunyé, T., & Diedrich, F. (2006). *Training a Joint and Expeditionary Mindset* (Final report to the Army Research Institute for the Behavioral and Social Sciences, contract number W74V8H-06-P-0189). Columbus, GA: The Wexford Group International, Inc.

Riccio, G., Sullivan, R., Klein, G., Salter, M., & Kinnison, H. (2004). *Warrior Ethos: Analysis of the concept and initial development of applications* (ARI Research Report 1827). Arlington, VA: US Army Research Institute for the Behavioral and Social Sciences. (DTIC No. ADA 428 065)

Scales, R.H. (2006). The second learning revolution. *Military Review,* Jan-Feb, 37-44.

Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches.* Thousand Oaks, CA: Sage.

Wallace, W. S. (2006). *TRADOC is the architect of the Army*. Hampton, VA: Army Science of Learning Workshop.

Yates, L.A. (2006). *The US military's experience in stability operations, 1789-2005* (Global war on terrorism occasional paper, v 15). Fort Leavenworth, KS: Combat Studies Institute Press.

APPENDIX A: LIST OF ACRONYMS

ACEP	Army Center for Enhanced Performance
ADA	Air Defense Artillery
AO	Area of Operations
BCKS	Battle Command Knowledge System
COE	Contemporary Operational Environment
COIN	Counterinsurgency
COL	Colonel
COTS	Commercial Off The Shelf
DAU	Defense Acquisitions University
DoD	Department of Defense
ECOE	Experts in the Contemporary Operational Environment
FAA	Functional Area Analysis
FNA	Functional Needs Analysis
FSA	Functional Solution Analysis
GEL	Guided Experiential Learning
IED	Improvised Explosive Device
JCIDS	Joint Capabilities Integration and Development System
JEM	Joint and Expeditionary Mindset
JFC	Joint Functional Concepts
JOC	Joint Operating Concepts
JOpsC	Joint Operations Concepts
MC3	Maneuver Captains Career Course
METT-TC	Mission, Enemy, Terrain, Troops, Time, Civilians
MOE	Measures of Effectiveness
MOP	Measures of Process
MOS	Military Occupational Specialty
NGO	Non-Governmental Organization
OGA	Other Government Agencies
OOTW	Operations Other Than War
OPFOR	Opposing Force
PIA	Post Independent Analysis
RSR	Right Seat Ride
R&D	Research and Development
SBIR	Small Business Innovation Research
SGI	Small Group Instructors
SME	Subject Matter Expert
SO	Stability Operations
S&T	Science & Technology
TDE	Tactical Decision Exercise
TTP	Tactics, Techniques, and Procedures
2LT	Second Lieutenant